United States Patent [19]

Bihler et al.

[11] **Patent Number: 4,580,329**

[45] **Date of Patent: Apr. 8, 1986**

[54] **PROCESSING MACHINE FOR WORKPIECES**

[75] Inventors: **Otto Bihler**, Schleiferweg 2, D-8959 Halblech, Fed. Rep. of Germany; **Eduard Brüller**, Trimbach, Switzerland

[73] Assignee: **Otto Bihler**, Fed. Rep. of Germany

[21] Appl. No.: **613,588**

[22] Filed: **May 23, 1984**

[30] **Foreign Application Priority Data**

May 27, 1983 [DE] Fed. Rep. of Germany 3319380

[51] **Int. Cl.**[4] **B23P 23/00**

[52] **U.S. Cl.** ..... **29/560;** 29/26 A; 72/442; 72/449; 74/425; 83/618; 212/210; 408/24

[58] **Field of Search** ..... 83/618; 74/665 H, 425, 74/416, 384; 29/26 A, 560, 34 R; 408/24; 72/440, 442, 444, 449, 454, 404, 478, 371, 381; 403/380, 354, 359; 212/210

[56] **References Cited**

U.S. PATENT DOCUMENTS

1,173,289	2/1916	McKee et al.	403/359
2,569,744	10/1951	Cecka	74/425
2,965,920	12/1960	Whittum	72/237
2,976,702	3/1961	Pietsch	403/359
3,257,835	6/1966	Coter et al.	72/38
3,709,025	1/1973	Laurencin	72/421
3,762,234	10/1973	Hoglund	72/425
3,783,792	1/1974	Cullom	212/210
4,196,501	4/1980	Shimajiri et al.	29/26 A
4,270,253	6/1981	Herb et al.	29/26 A

FOREIGN PATENT DOCUMENTS

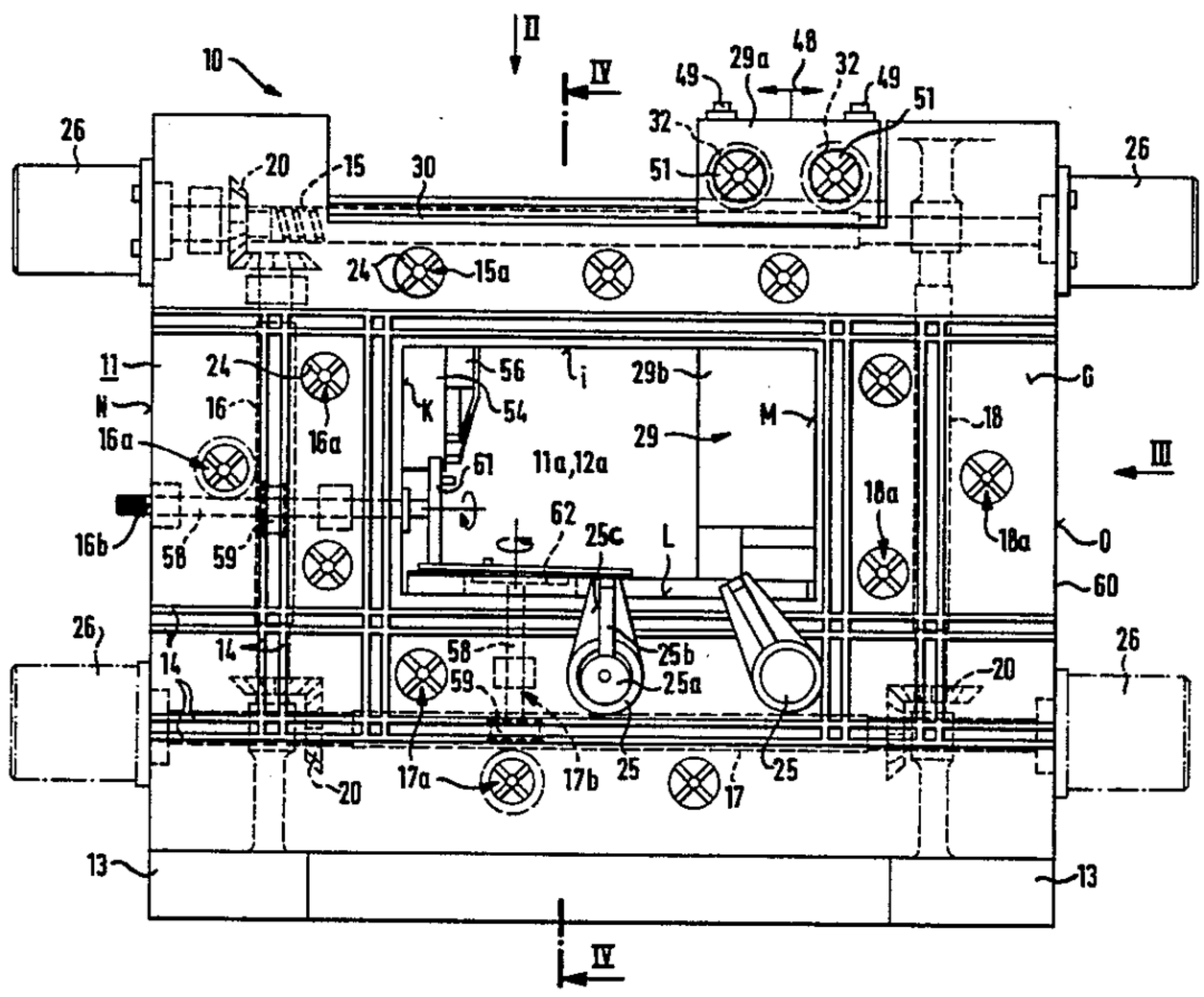
1019526	11/1957	Fed. Rep. of Germany .	
1887318	2/1964	Fed. Rep. of Germany .	
2347498	4/1975	Fed. Rep. of Germany .	
2457048	6/1976	Fed. Rep. of Germany .	
2625022	12/1976	Fed. Rep. of Germany .	
555199	6/1923	France	74/384
0060757	5/1980	Japan	74/425
344703	3/1931	United Kingdom	74/56

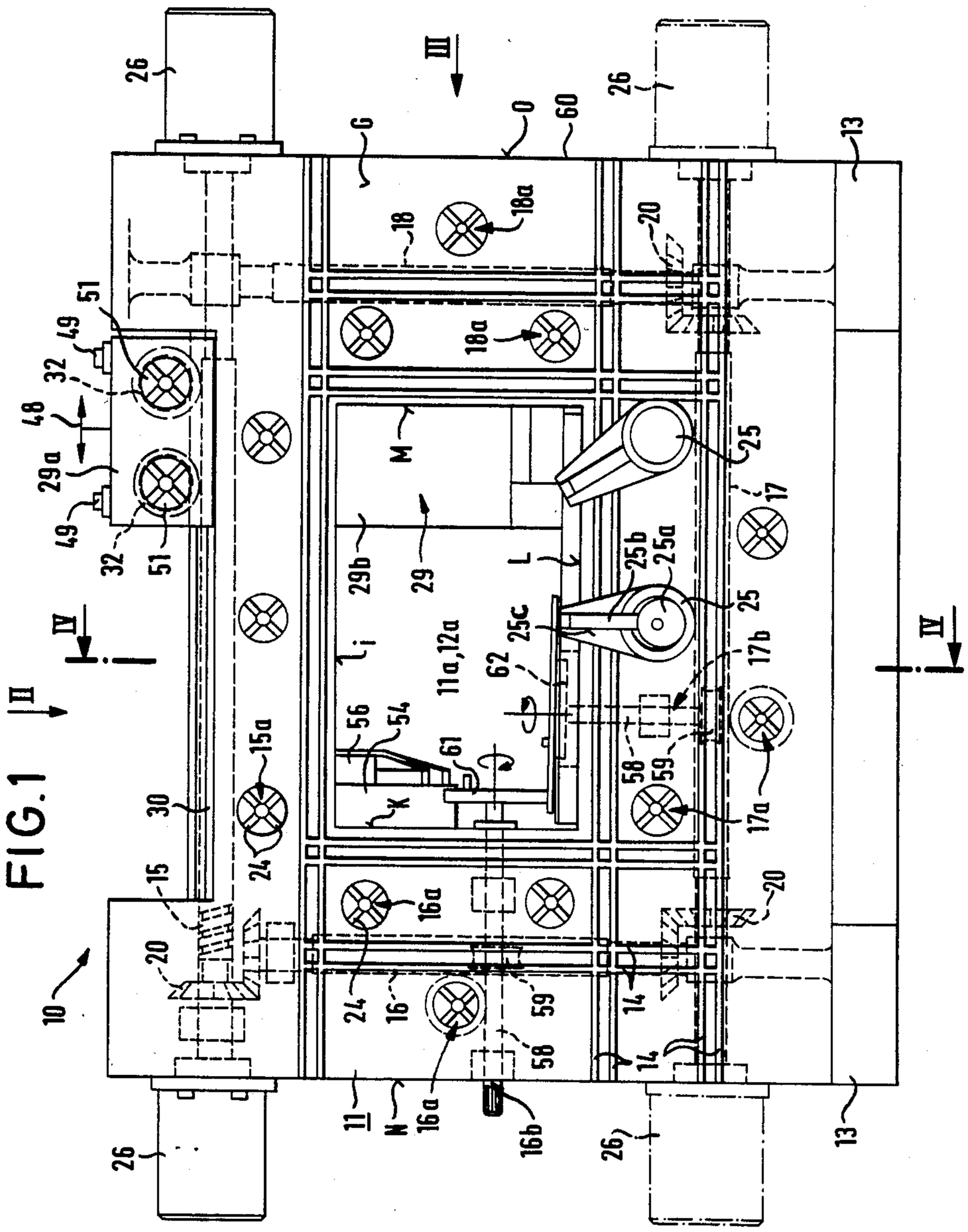
Primary Examiner—Francis S. Husar
Assistant Examiner—Robert Showalter
Attorney, Agent, or Firm—Toren, McGeady, Stanger, Goldberg & Kiel

[57] **ABSTRACT**

A workpiece processing machine comprises a stationary main frame **10** with at least one main processing plane G. On the one side of this main processing plane there are arranged worm shafts **15, 16, 17** and **18** extending with their axes substantially parallel with the main processing plane G, mounted in the stationary main frame **10** and connected for drive with one another. On the other side of the main processing plane G there are provided securers for the securing of processing units **25** on the stationary main frame **10.** To each worm shaft there is allocated at least one main power take-off position **15***a,* **16***a,* **17***a,* **18***a* for the drive connection of a processing unit **25** with the respective worm shaft **15, 16, 17, 18** through a worm wheel, meshing with the worm shaft, with worm wheel axis perpendicular to the main processing plane G. At least three worm shafts connected for drive are arranged along mutually adjoining sides of a polygonal line.

80 Claims, 19 Drawing Figures

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II
I
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6
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60
13
18
18a
20
51
49
32
48
29a
M
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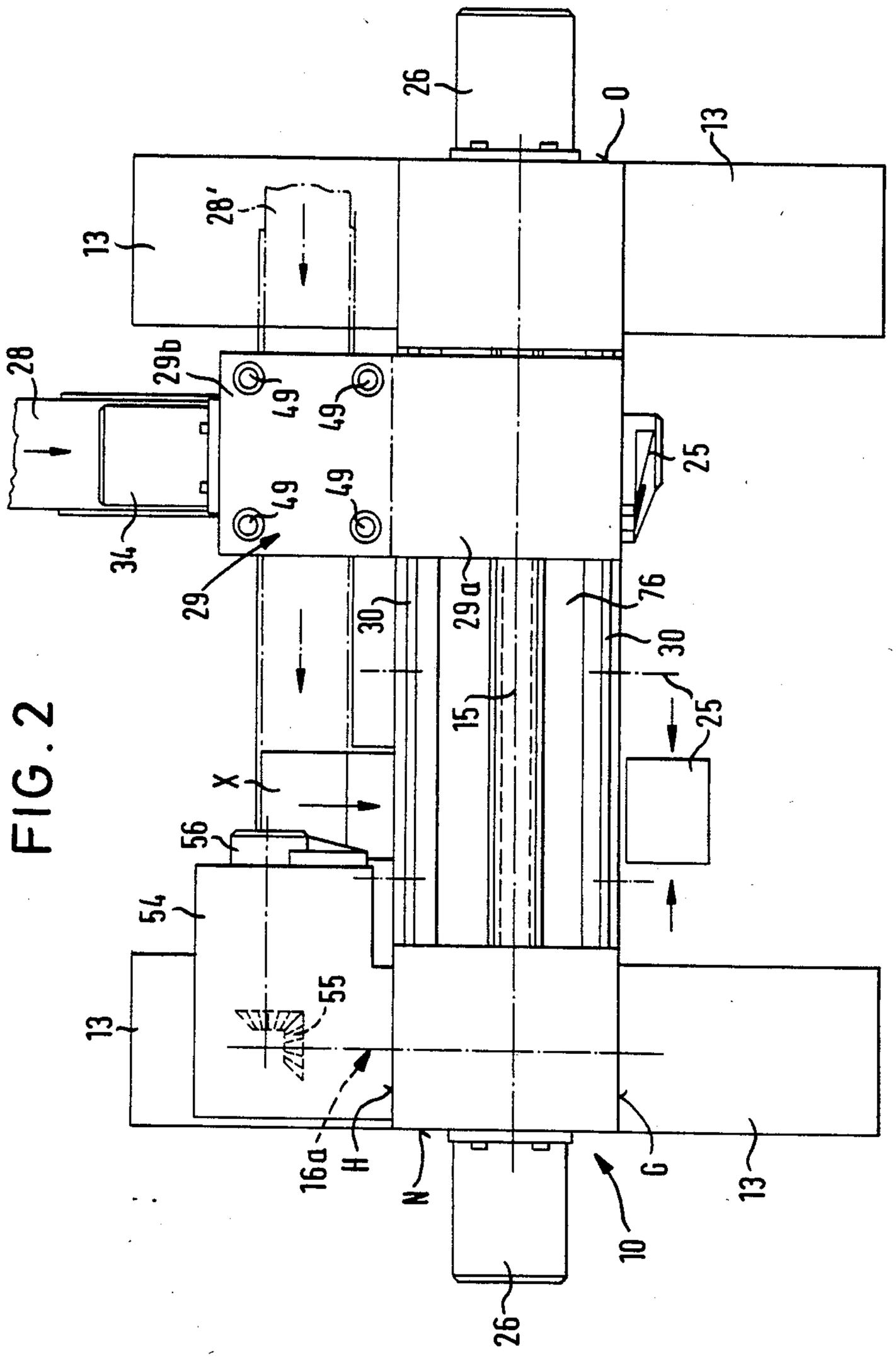
17
29b
29
L
25b
25a
25c
25
62
11a,12a
17b
56
54
61
58
59
17a
15a
30
24
15
16a
20
10
16
14
11
N
16b
26

FIG.1


26
0
13
28'
13
28
29b
49
49
49
49
25
34
29
30
29a
76
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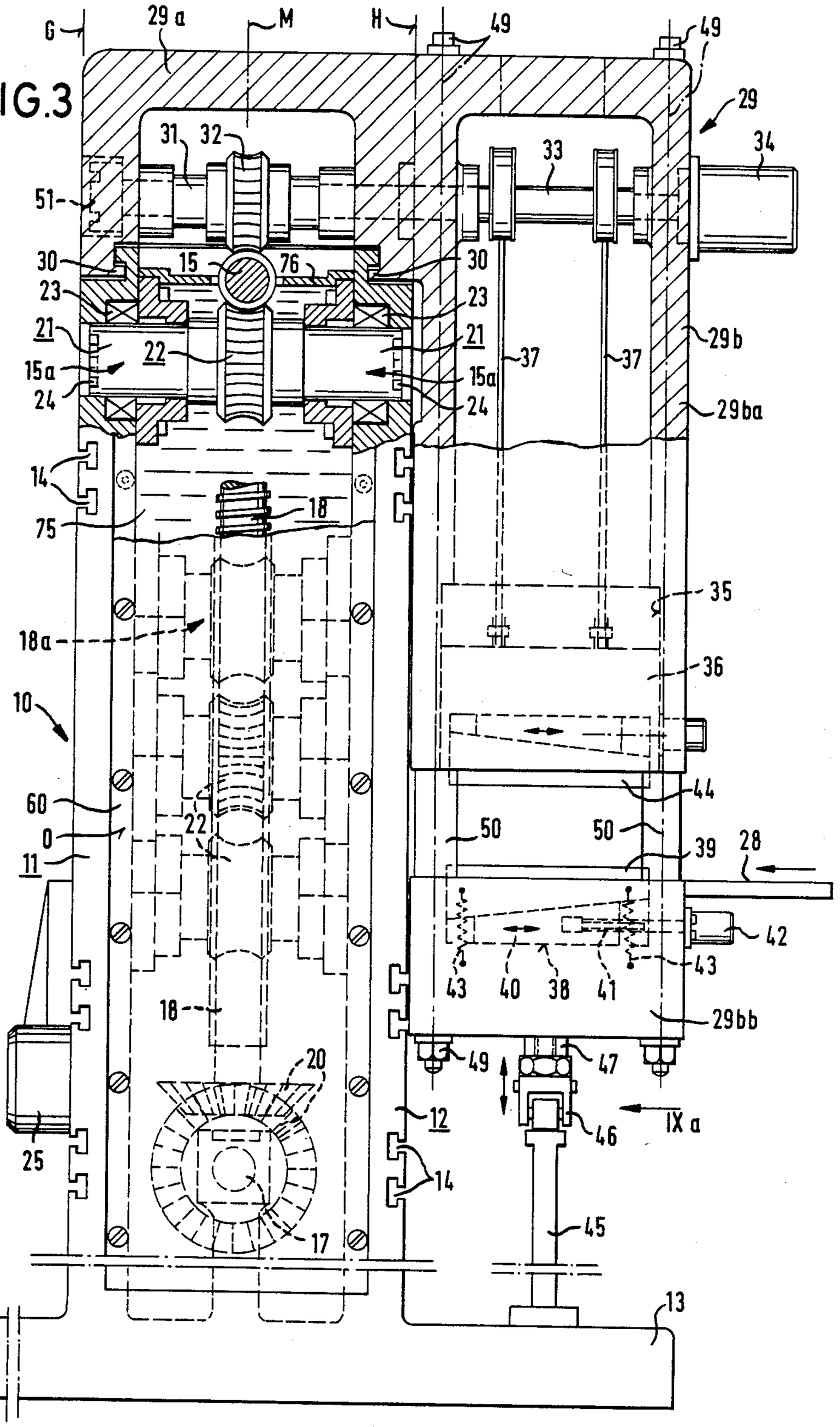
55
13
16a
H
N
6
10
6
13

FIG. 2

FIG.3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29a
M
H
49
49
29
34
33
31
32
51
30
15
76
30
23
23
21
21
22
37
37
29b
15a
15a
24
24
29ba
14
18
75
35
18a
36
10
60
0
22
11
44
50
50
39
28
42
43
43
40
38
41
29bb
18
20
49
47
12
IX a
46
25
14
45
17
13
13

FIG. 4

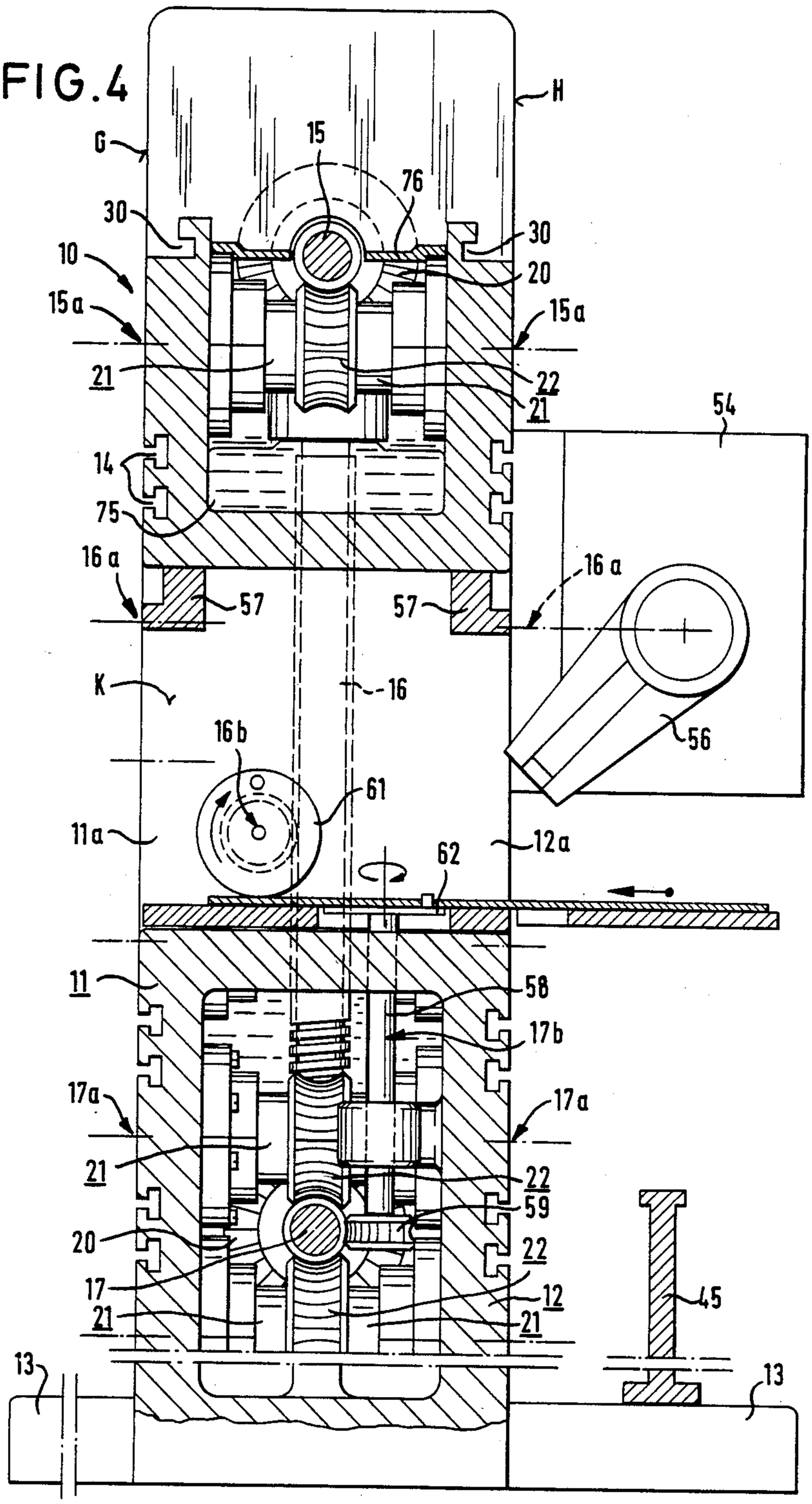

H
G
15
76
30
30
10
20
15a
15a
21
22
21
54
14
75
16a
16a
57
57
K
16
16b
61
56
11a
12a
62
11
58
17b
17a
17a
21
22
59
20
22
17
12
21
21
45
13
13

FIG. 5

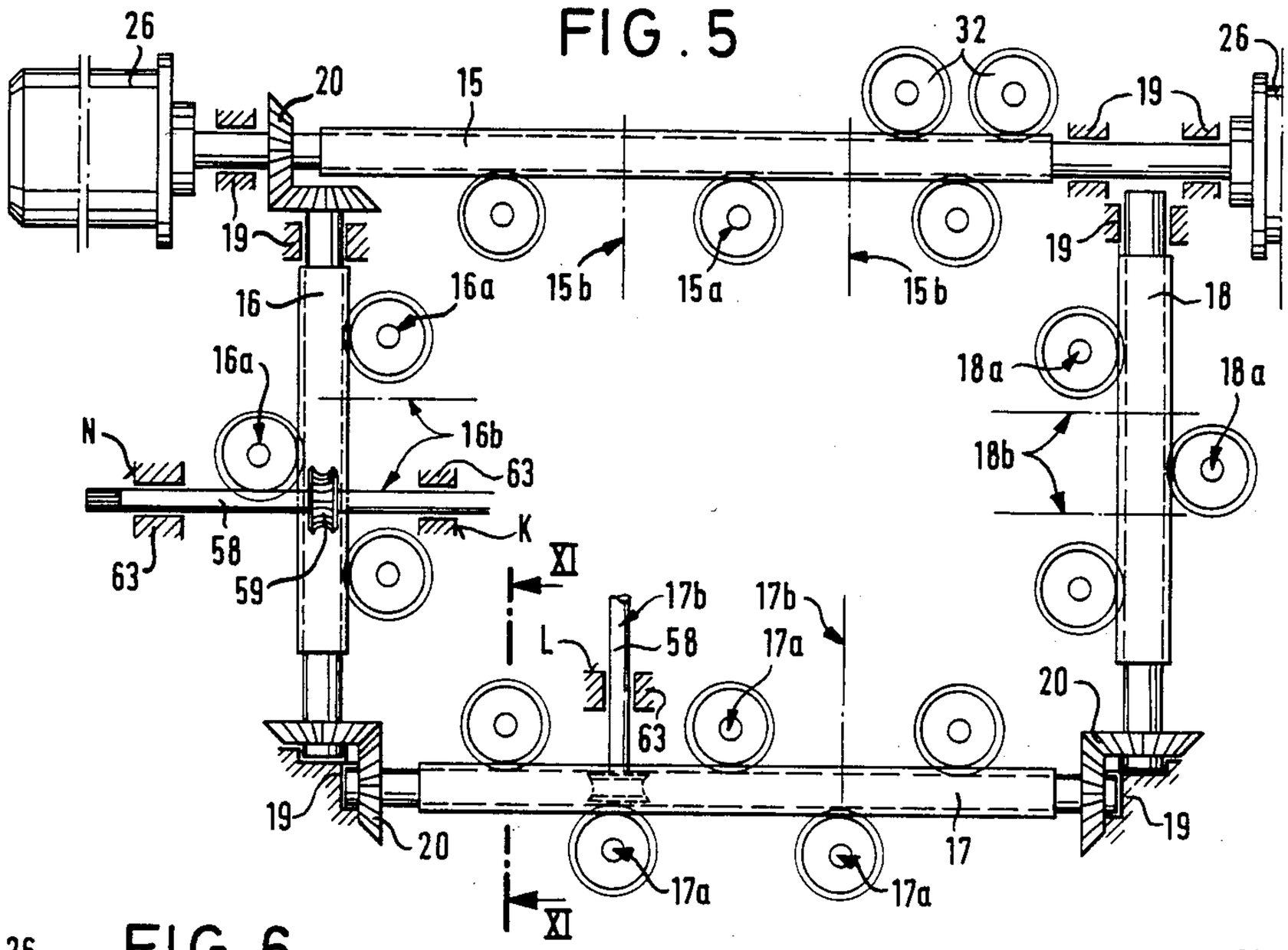

26
20
15
32
19
16
16a
15b
15a
18
18a
N
16b
63
58
59
K
XI
17b
L
17a
17
18b

FIG. 6

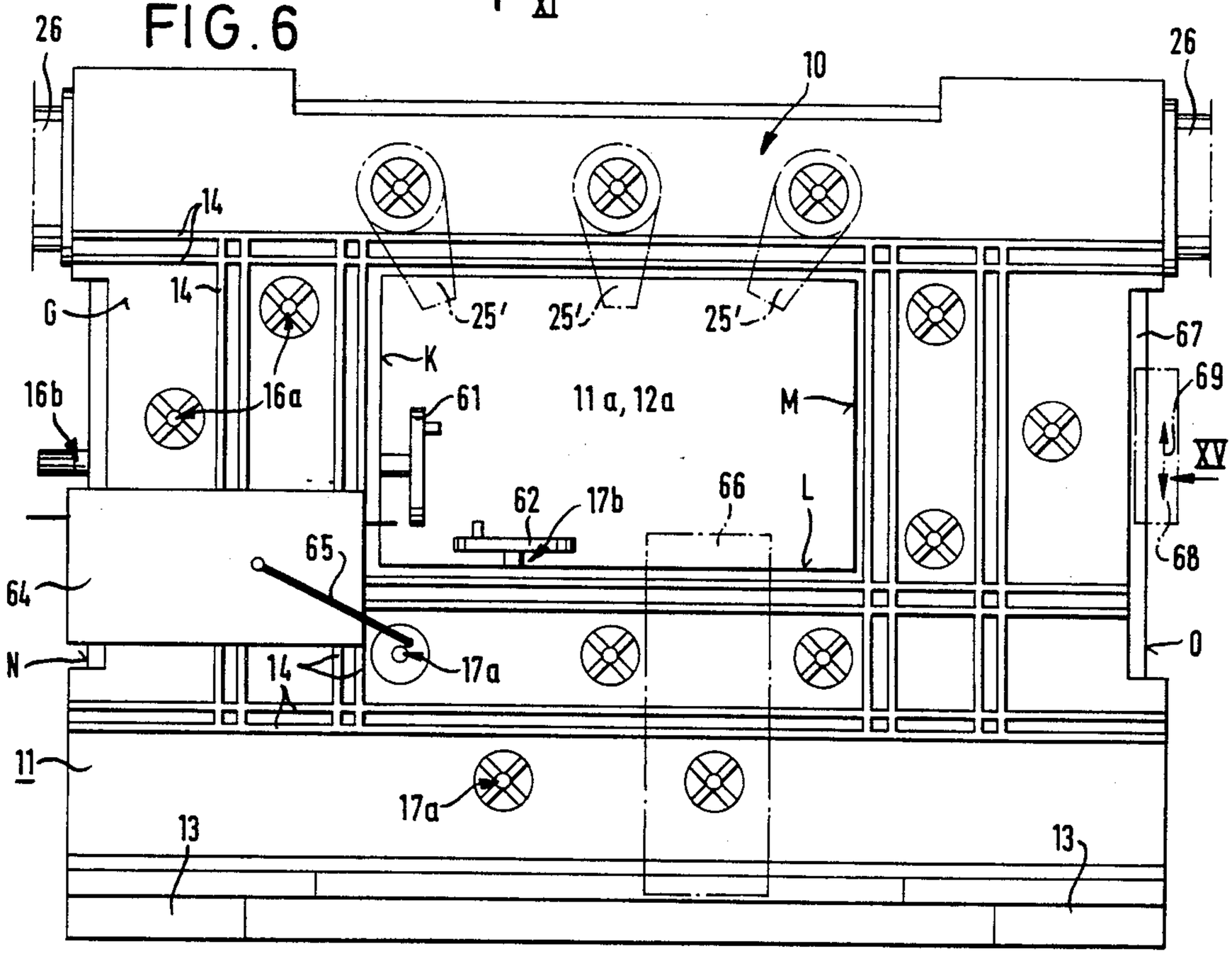

26
10
14
G
25'
K
16b
16a
61
11a, 12a
M
62
17b
66
L
XV
67
69
68
65
64
N
17a
O
11
13

FIG.7

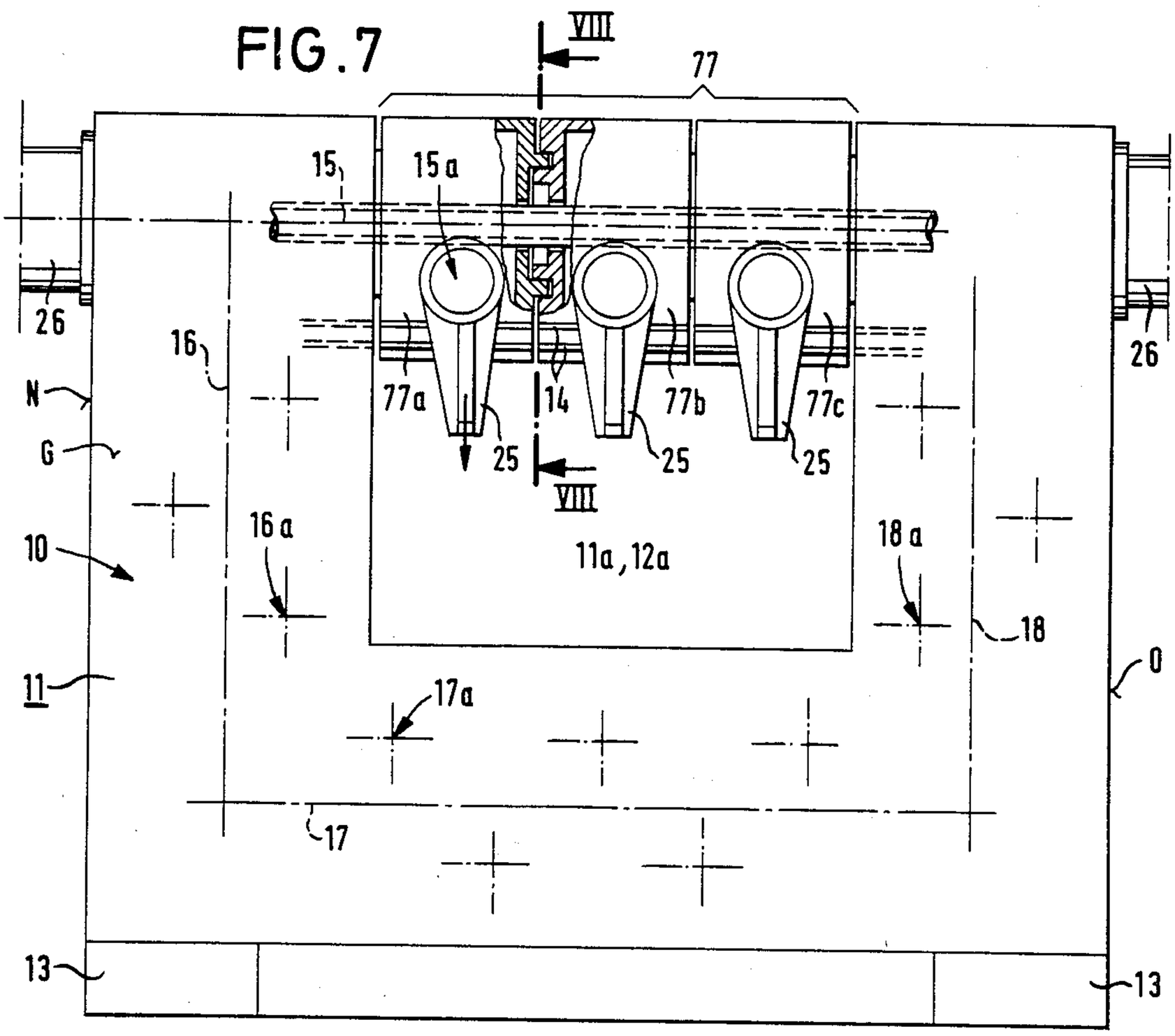

VIII
77
15
15a
26
16
N
G
10
11
77a
14
77b
77c
25
25
25
VIII
11a, 12a
16a
18a
18
17a
17
0
13
13

FIG.8

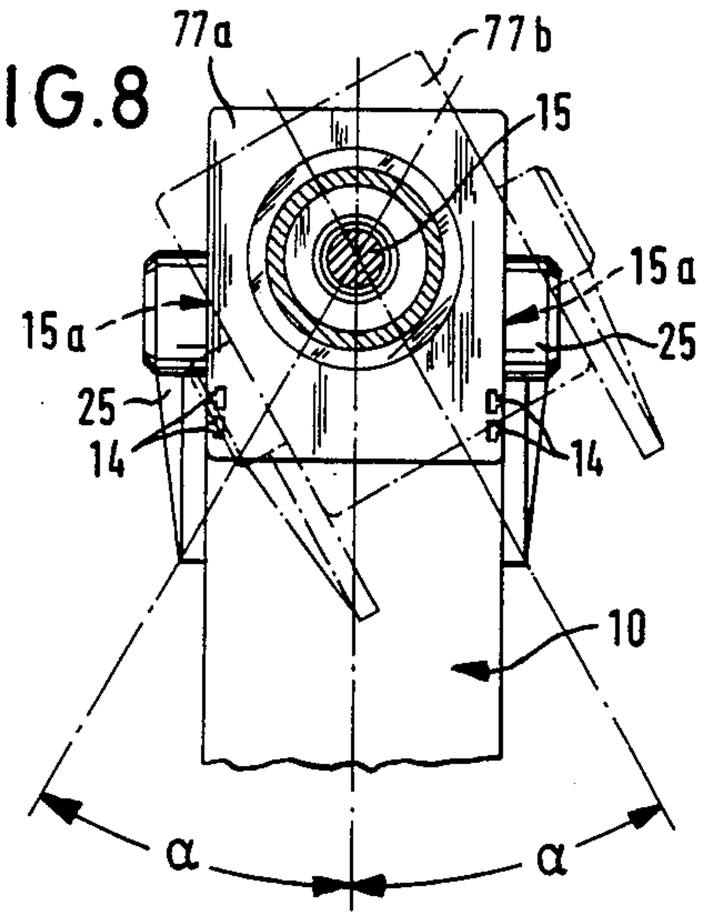

77a
77b
15
15a
15a
25
25
14
14
10
α
α

FIG. 9a

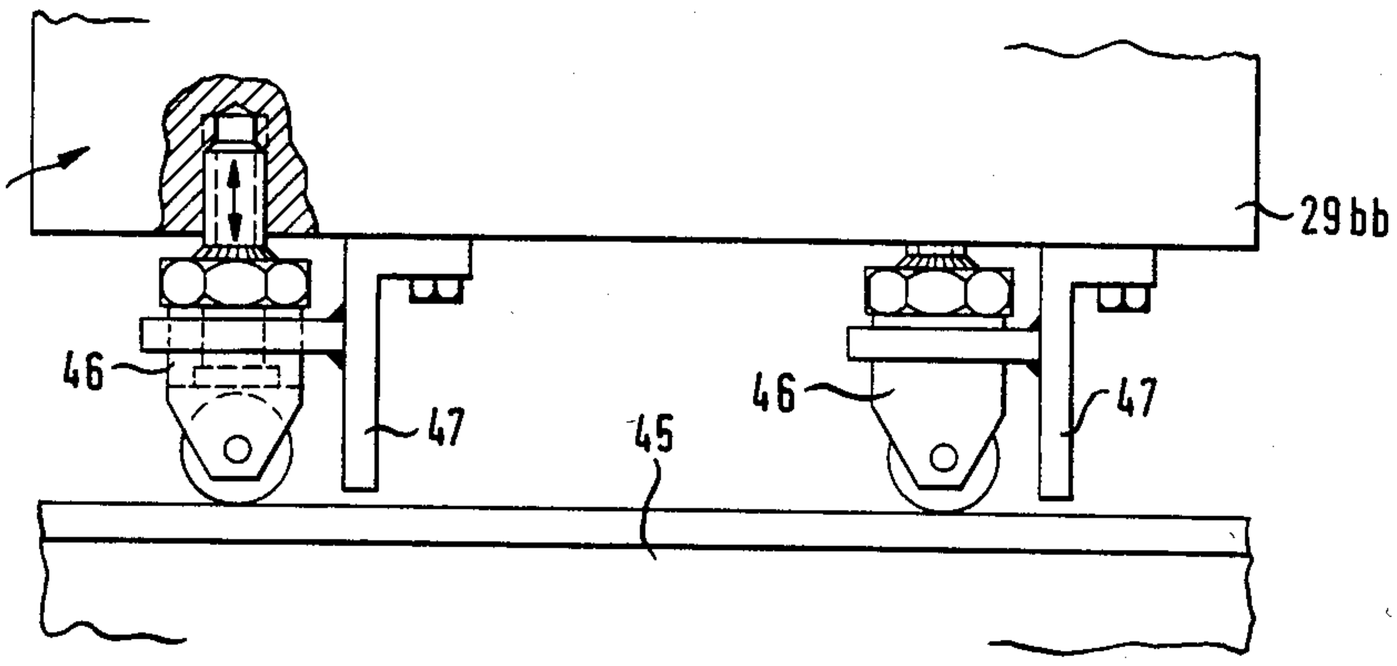


FIG. 9

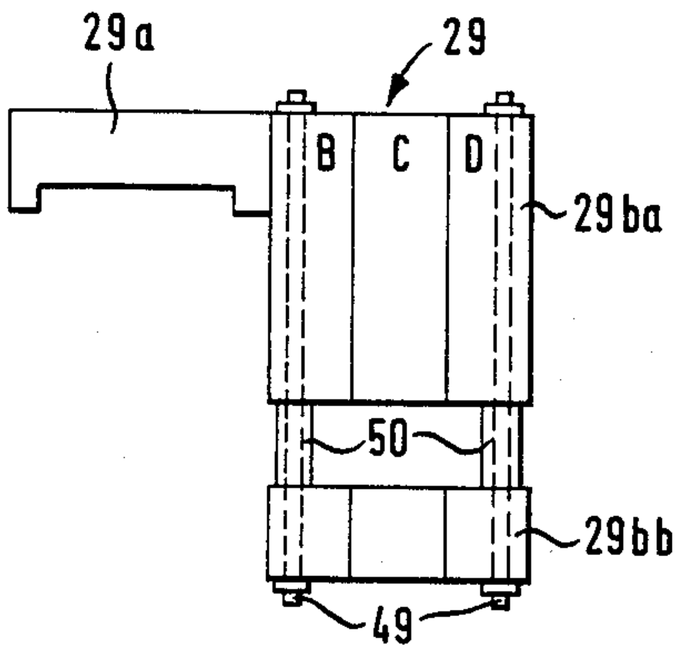


FIG. 10

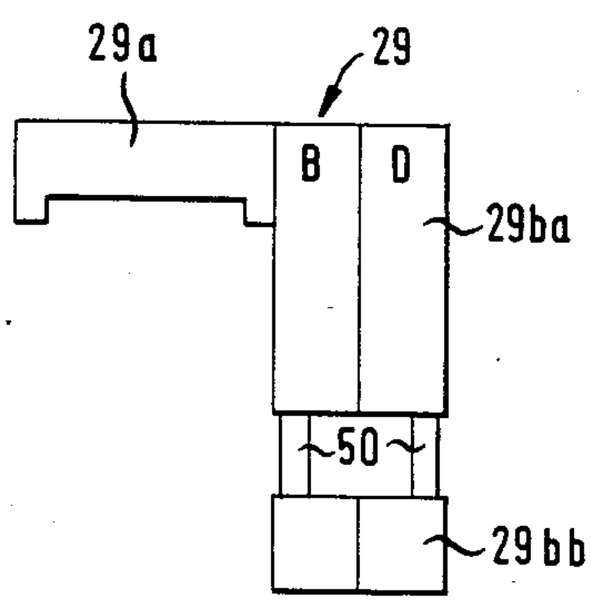
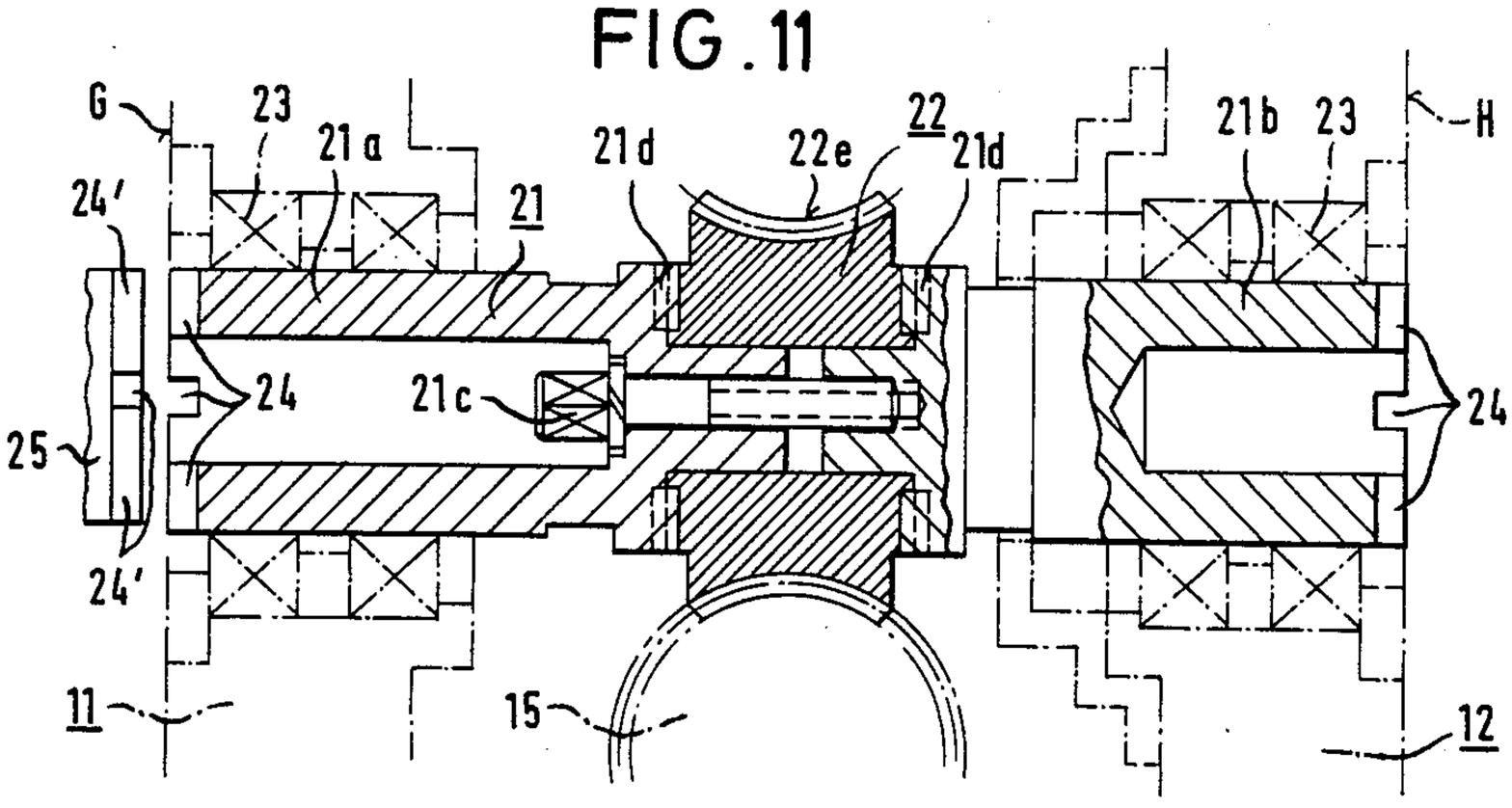


FIG. 11



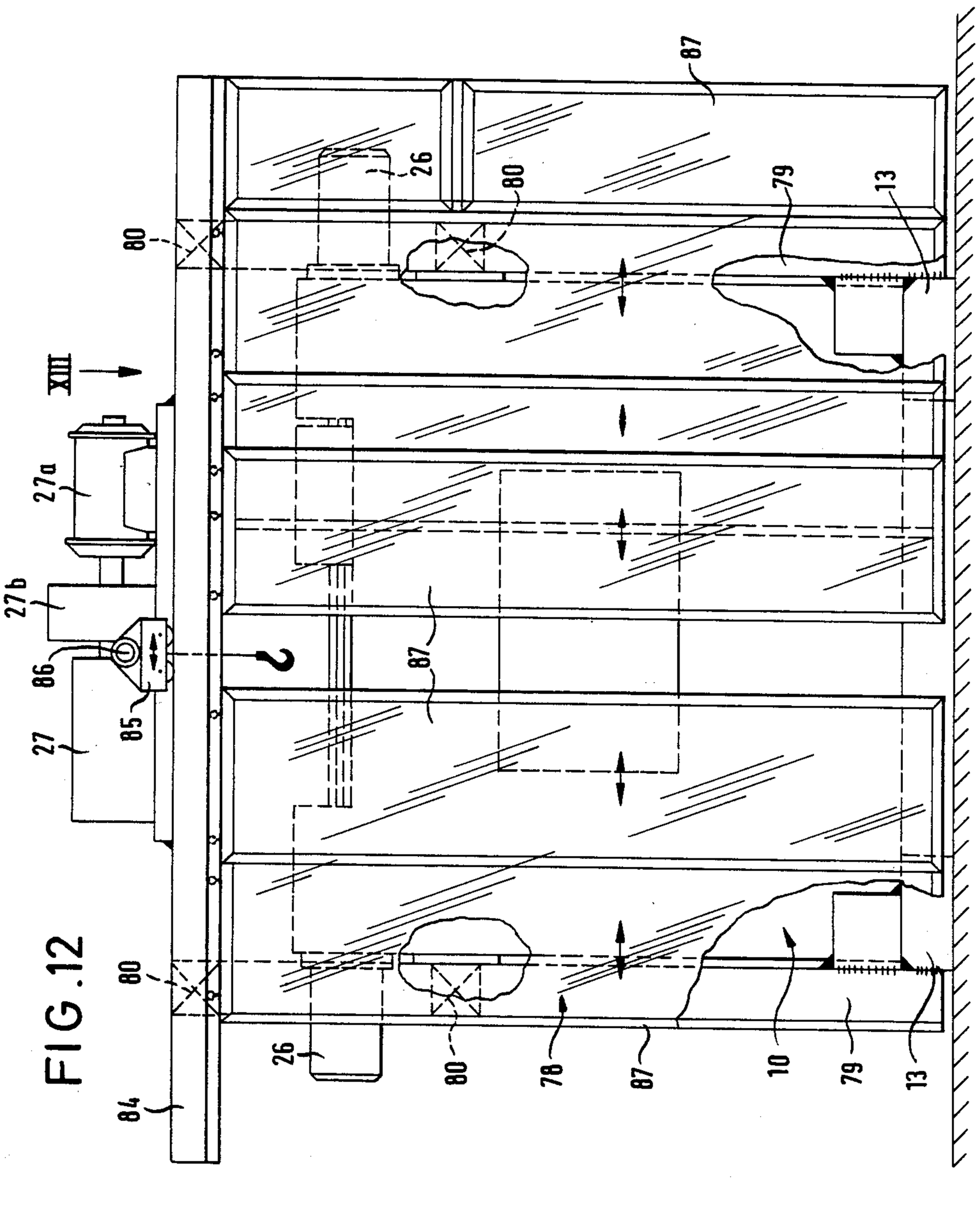
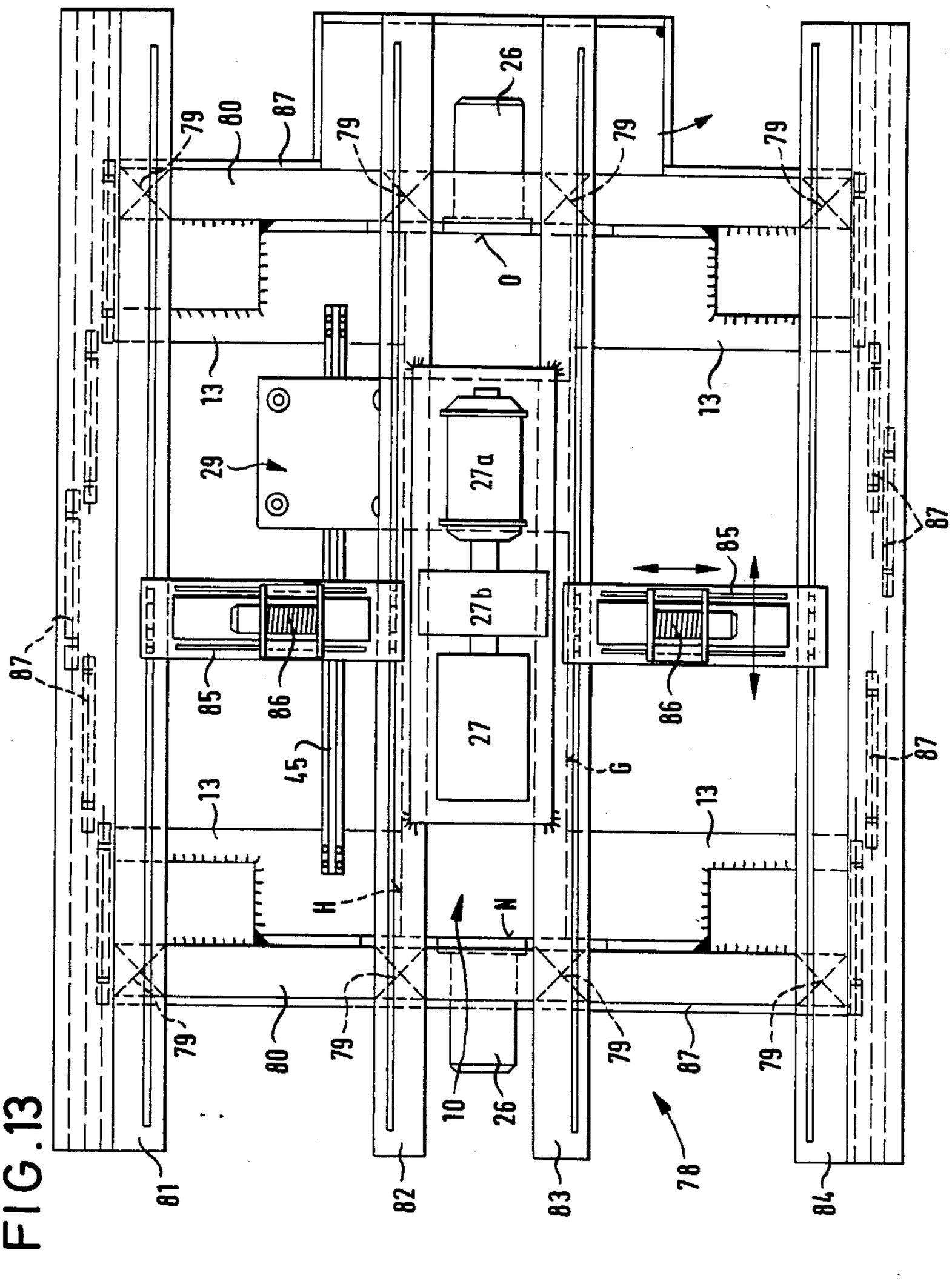


FIG.12


87
79
80
87
79
26
79
79
0
13
13
29
27a
85
87
27b
85
86
86
87
27
45
G
13
H
N
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80
79
10
26
79
87
79
87
81
82
83
78
84

FIG.13

FIG.14

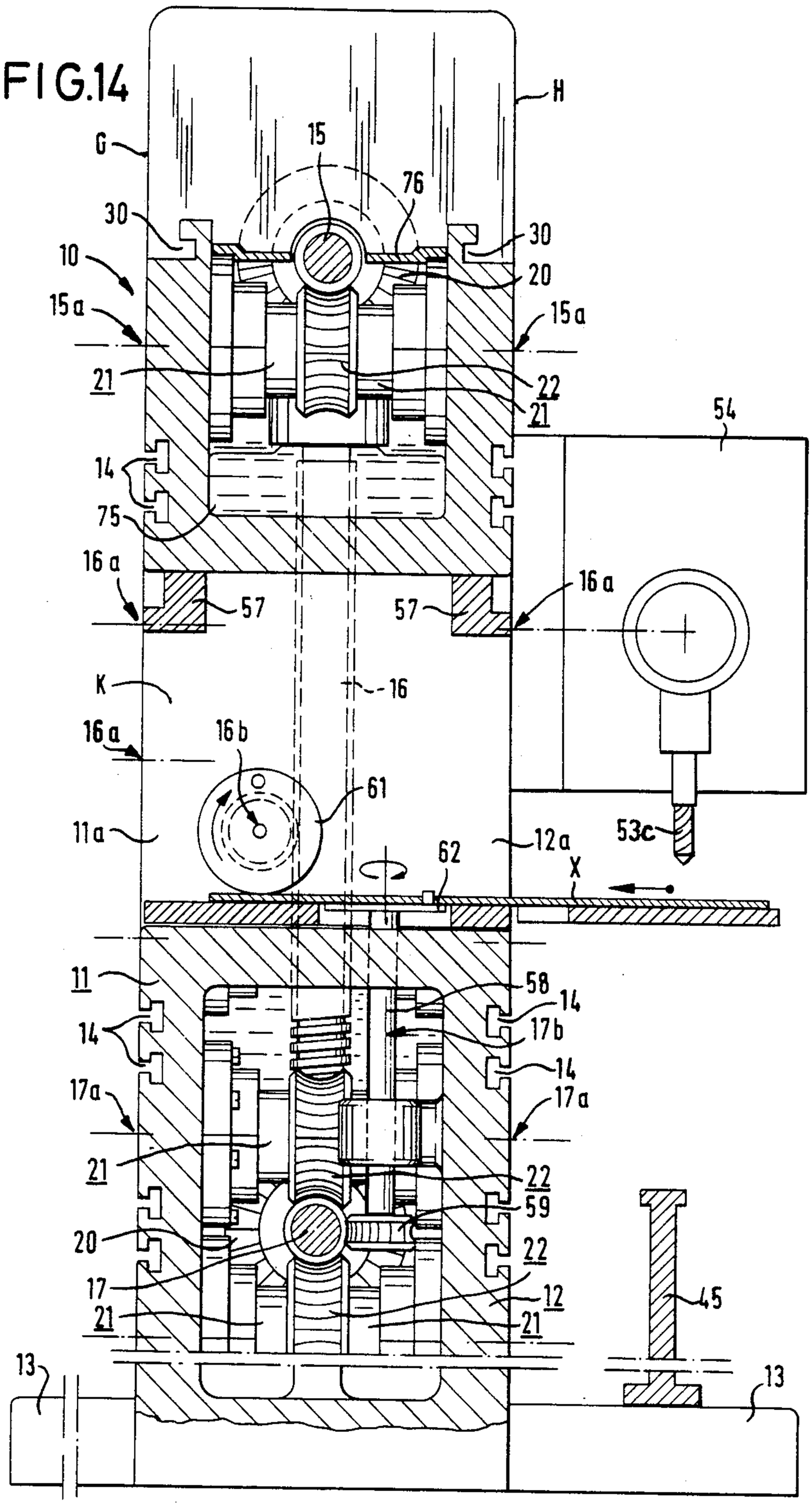

G
H
15
76
30
30
10
20
15a
15a
21
22
21
54
14
75
16a
57
57
16a
K
16
16a
16b
61
11a
62
12a
53c
X
11
58
14
14
17b
14
17a
17a
21
22
59
20
22
17
12
21
21
45
13
13

FIG. 15

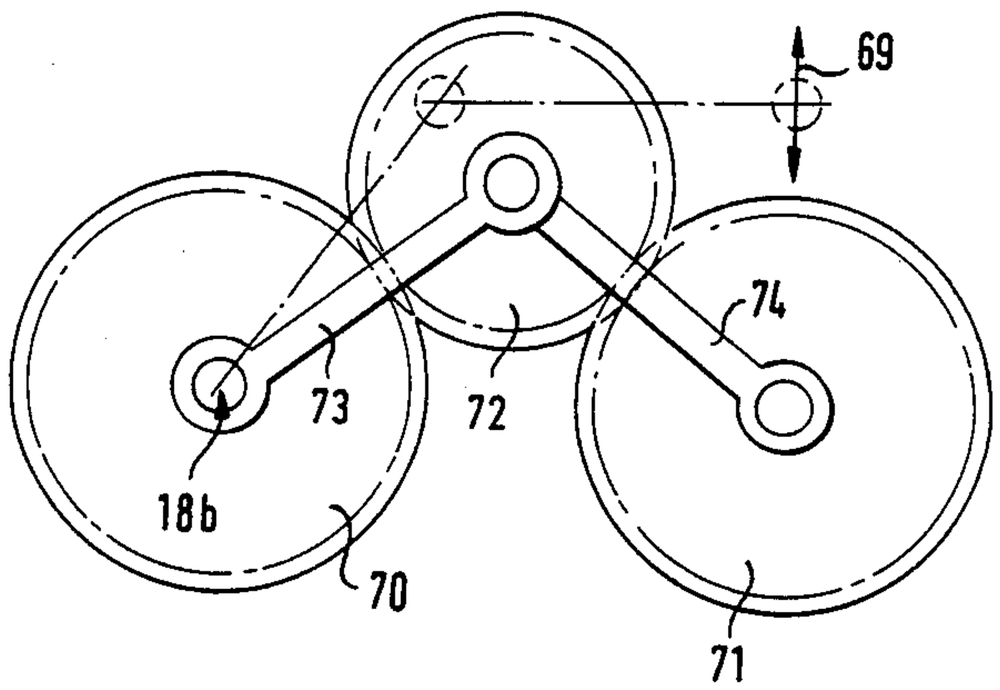
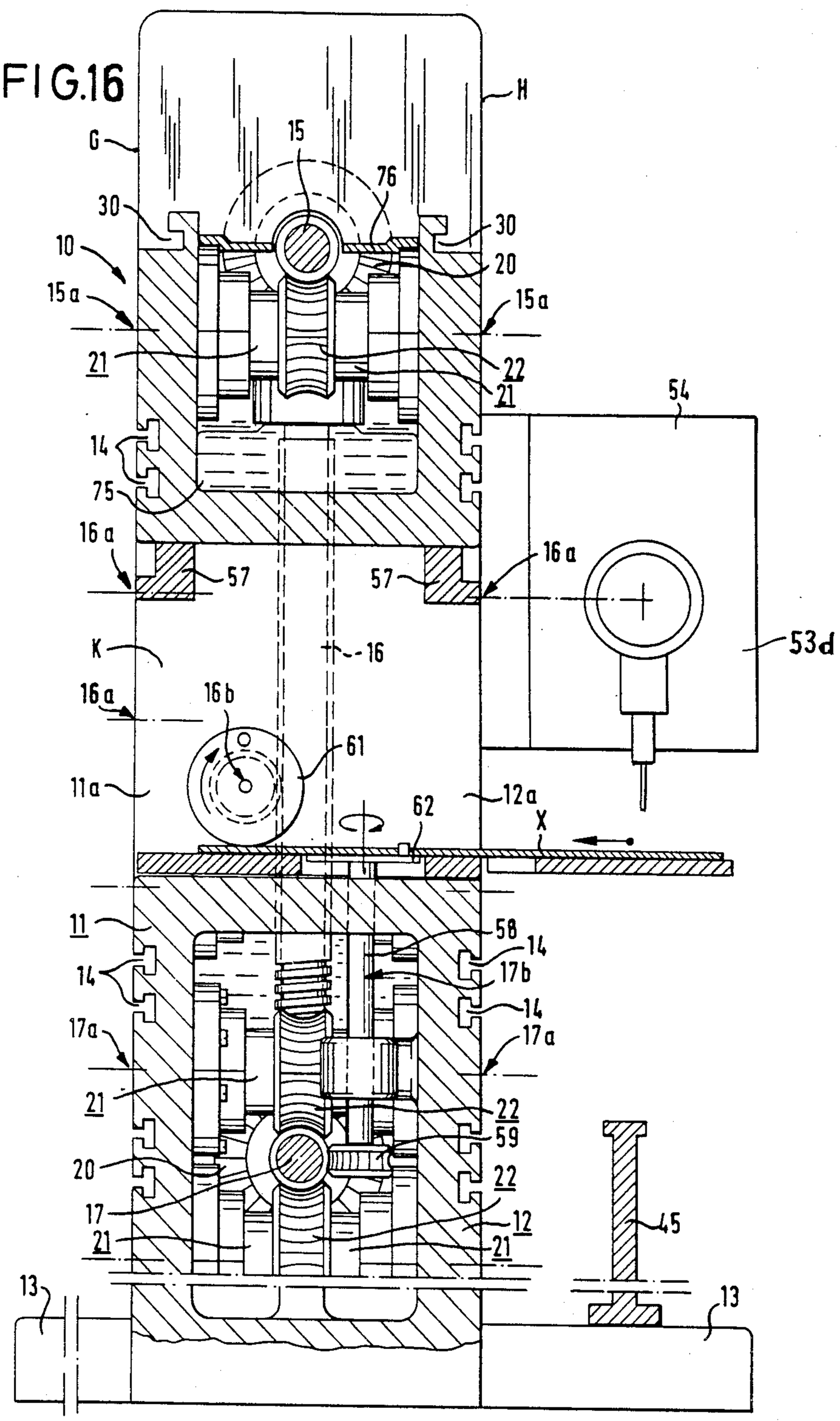


FIG.16


H
G
15
76
30
30
10
20
15a
15a
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22
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57
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16a
53d
K
16
16a
16b
61
11a
62
12a
X
11
58
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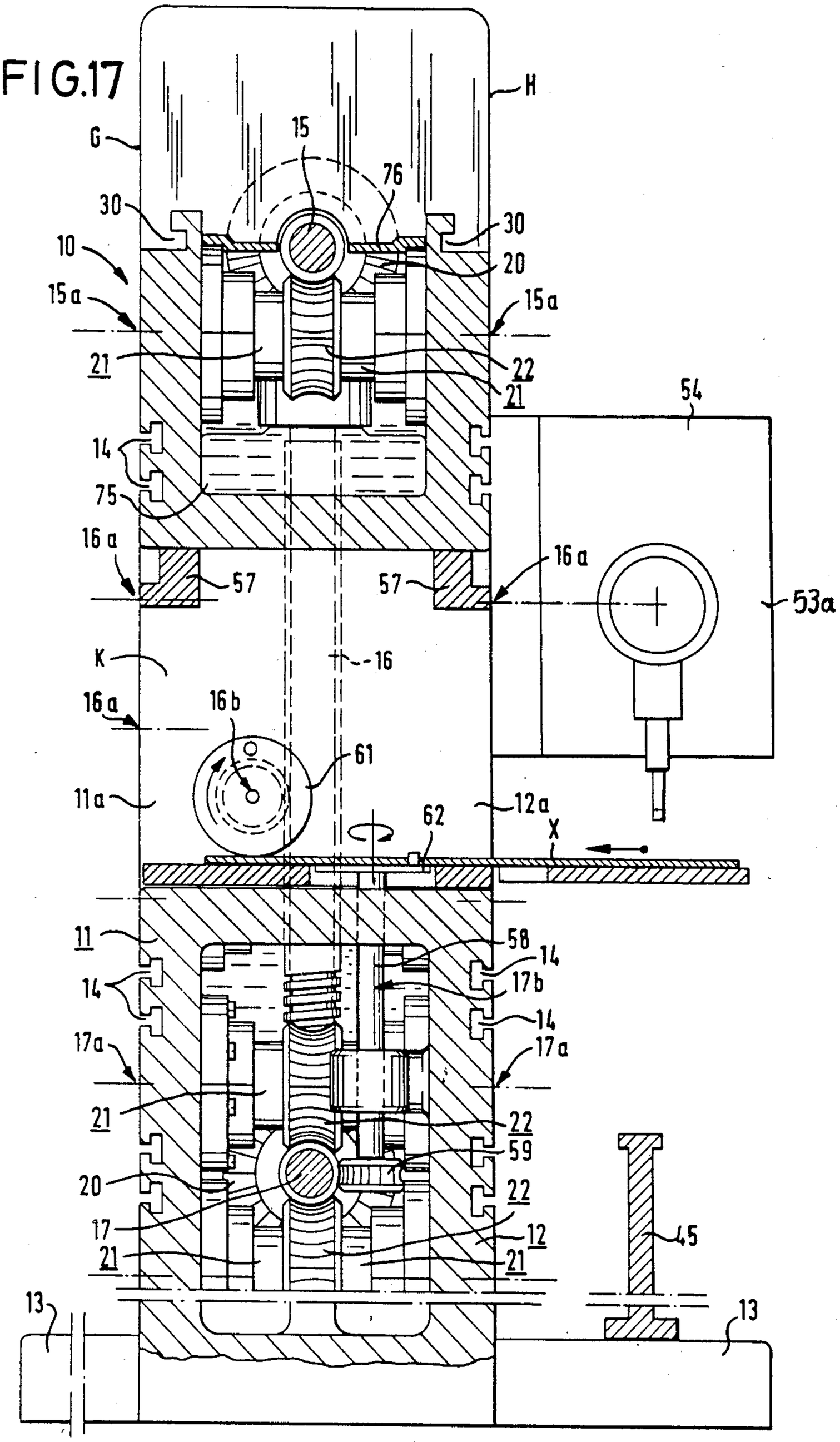
22
17
12
21
21
45
13
13

FIG.17


H
G
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22
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14
75
16a
57
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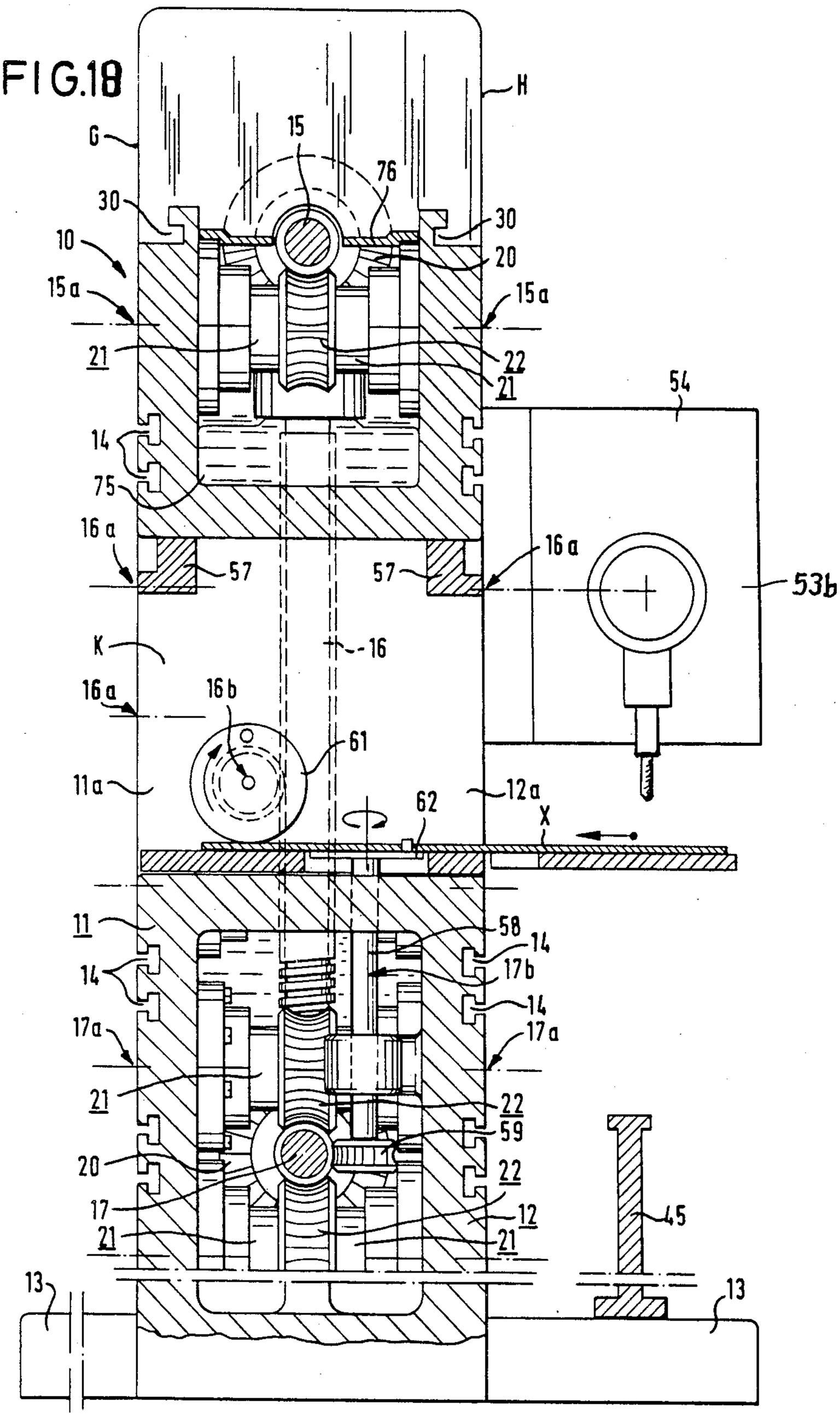
16a
53a
K
16
16a
16b
61
11a
62
12a
X
11
58
14
14
17b
14
17a
17a
21
22
59
20
22
17
12
21
21
45
13
13

FIG.18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G
15
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30
10
15a
21
22
20
14
75
16a
57
54
53b
K
16
16b
61
11a
12a
62
X
11
58
17b
17a
59
12
45
13

PROCESSING MACHINE FOR WORKPIECES

BACKGROUND OF THE INVENTION

The invention relates to a workpiece processing machine with a stationary main frame (**10**) hving at least one main processing plane (G, H,) worm shafts (**15, 16, 17, 18**) arranged on the one side of this main processing plane (G, H) with their axes substantially parallel with the main processing plane, mounted in the stationary main frame (**10**) and connected with one another for drive securing means (**14**) arranged on the other side of the main processing plane for the securing the processing units (**25, 29**) on the stationary main frame and—allocated to each worm shaft (**15, 16, 17, 18**)—at least one main power take-off position (**15***a*, **16***a*, **17***a*, **18***a*) for the drive connection of a processing unit (**25, 29**) with the respective worm shaft (**15, 16, 17, 18**) through a worm wheel (**22**) meshing with the worm shaft with the worm wheel axis perpendicular to the main processing plane (G, H).

SUMMARY OF THE INVENTION

Such a workpiece processing machine was the object of an earlier U.S. Patent application Ser. No. 463,556, to the same inventors, now abandoned.

The invention is based upon the problem of so developing a workpiece processing machine of the kind according to the classification that processing units can be fitted in the largest possible number of different positions and with different working directions in relation to the workpiece to be processed, without complicated drive transmissions.

For the solution of this problem at least three worm shafts connected for drive are arranged along mutually adjoining sides of a polygonal line.

Further developments of the invention are set forth in the following description.

The additional problems preceding these further development measures and the resultant advantages appear from the description of the Figures.

The accompanying FIGURES explain the invention by reference to examples of embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** represents a front view of a workpiece processing machine according to the invention;

FIG. **2** represents a plan view of the machine according to FIG. **1** in the direction of the arrow II in FIG. **1**;

FIG. **3** represents a side view of the machine in the direction of the arrow III in FIG. **1**, partially broken away;

FIG. **4** represents a section along the line IV—IV in FIG. **1**;

FIG. **5** represents the drive layout of the worm shafts and associated power take-off positions in the machine according to FIG. **1**;

FIG. **6** represents a front view corresponding to that in FIG. **1** with a strip feed unit and with additional continuously adjustable processing units;

FIG. **7** represents a front view corresponding to that in FIG. **1** in a modified form of embodiment;

FIG. **8** represents a section along the line VIII—VIII in FIG. **7**;

FIG. **9** and FIG. **10** represent diagrammatic detail representations of FIG. **3**;

FIG. **9***a* represents a diagrammatic detail illustration of FIG. **3** in the direction of the arrow IXa of FIG. **3**;

FIG. **11** represents the mounting of a worm wheel shaft in two mutually parallel main processing panels in engagement with the pertinent worm shaft;

FIG. **12** represents a front view in the direction of view of FIG. **1** in a form of embodiment in which the main frame of the machine is enclosed by an outer support frame and this support frame serves as carrier of a cladding;

FIG. **13** represents a plan view of the arrangement according to FIG. **12** in the direction of the arrow XIII in FIG. **12**;

FIGS. **14, 16, 17,** and **18** represents a section along the line IV—IV in FIG. **1** in a machine equipped with other processing units;

FIG. **15** represents a detail of the arrangement according to FIG. **6** in the direction of the arrow XV in FIG. **6**.

DETAILED DESCRIPTION OF THE INVENTION

In FIG. **1** a main frame is designated quite generally by **10**. This frame **10**, as may be seen from FIG. **3**, is formed essentially by two main processing panels **11** and **12** which are produced together with floor support spars **13** as a one-piece casting. The two main processing panels **11** and **12** define two main processing planes G and H (FIG. **3**). In the main processing panels **11** and **12** there are provided dovetail grooves **14** for the securing of processing units or other machine accessories. In the main frame **10** four worm shafts **15, 16, 16** and **18** are arranged in the central plane M between the two main processing planes G and H, between the two main processing panels **11** and **12**. The shaft arrangement is seen in detail from FIG. **5**. The shafts **15, 16, 17** and **18** are mounted in bearings **19** which are produced integrally with the casting comprising the main processing panels **11** and **12**.

The four worm shafts **15** to **18** are arranged along a rectangular polygon line. The shafts **15** and **16, 16** and **17** and **17** and **18** are connected with one another for drive by bevel gear stages **20**. Several main power take-off positions **15***a*, **16***a*, **17***a* and **18***a* are allocated for each of the worm shafts **15, 16, 17,** and **18**, namely in each of the main processing panels **11** and **12**. The main power take-off positions **15***a* to **18***a* serve for the drive of processing units which can be secured by mens of the dovetail grooves **14** of the main processing panels **11** and **12**.

In FIG. **3** it is illustrated how two main power take-off positions **15***a* in the two main processing panels **11** and **12** are formed in detail. There one may see a worm wheel shaft **21** with a worm wheel **22**. The worm wheel shaft **21** is rotatably mounted in bearings **23** in the two main processing panels **11** and **12**. The worm wheel **22** is connected fast in rotation with the worm wheel shaft **21** and is in drive engagement with the worm shaft **15**. The worm of the worm shaft **15** and the toothing of the worm wheel **22** are formed so that the worm wheel shaft **21** rotates with a rotation rate corresponding to about one-fifth of the rotation rate of the worm shaft **15**.

The worm wheel shafts **21** are provided at their ends lying in the main processing planes G and H with coupling devices **24** which are intended to engage with corresponding counter-coupling devices of attachable processing units, so that these processing units can be driven by the worm wheel shafts **21**. Details of these

coupling devices will be discussed further in connection with FIG. **11**.

In FIGS. **1** and **3** there are seen, represented diagrammatically, several bending units **25** which are driven there from the worm shaft **17** through pertinent main power take-off positions **17***a*. The bending units **25**, as indicated diagrammatically in FIG. **1**, are formed for example each by a cam **25***a*, a bending ram **25***b* and a bending ram guide **25***c*, the cam **25***a* being driven from the worm shaft **17** through the pertinent power take-off position **17***a*.

As may be seen from FIG. **1**, main power take-off positions **16***a*, **17***a* and **18***a* are allocated on both sides of the respective worm shaft to the worm shafts **16**, **17** and **18**, the main power take-off positions on the one side being staggered in relation to the main power take-off positions on the other side. In this way a great multiplicity of selection results for the position of the bending units according to the bending task to be performed in each case.

As may be seen from FIG. **1**, the two ends of the worm shaft **15** and possibly also the two ends of the worm shaft **17** are connected each with a hydraulic drive motor **26**. The hydraulic motors **26** are connected to a common pressure supply pump **27** (see FIG. **12**) and in fact the hydraulic drive motors **26** can be fed from the hydraulic pressure supply pump **27** without quantity divider. Due to the presence of a plurality of hydraulic drive motors the worm shafts are relieved of load and the torsions of the worm shafts are largely excluded. At this point it should also be mentioned that the torques acting on the worm shafts **15** to **18** are in any case relatively small in comparison with the torques taken from the processing units, since the worm shafts **15** to **18** rotate at a substantially greater rate than the worm wheels **22** and their worm wheel shafts **21**.

The engagement between the worm wheels **22** and the worm shafts **15** to **18** is free from flank play, since in each case several teeth of the worm wheels **22** are in engagement with worm turns of the worm shafts **15** to **18**; this is a substantial advantage over the torque transmission by pairs of spur gears, where in unfavourable situations of engagement in each case only one tooth of each wheel is in engagement with one tooth of the other wheel.

Thus with the formation in accordance with the invention an exact play-free synchronization of all power take-off positions, that is worm wheel shafts **21**, with the worm shafts **15** to **18** and the drive motors **26** is achieved.

The machine as described hitherto is intended and adapted for workpieces to be processed in both main working planes G and H. The workpieces can be obtained for example from strip metal material which is fed to the main processing plane H (FIG. **2**). In FIG. **2** a strip material feed **28** is represented in solid lines and a strip material feed **28'** in dot-and-dash lines. This is intended to signify that fundamentally a strip supply is possible parallel to the main processing planes G and H but also perpendicular to the main processing planes G and H. The selection of the strip feed direction is here dependent upon the workpiece to be produced in each case. It is here to be noted that specific bending operations parallel to the rolling direction of the strip and other bending operations perpendicular to the rolling direction of the strip are to be carried out.

In order to obtain individual cut-out shapes from the strip material which is fed according to FIG. **2**, on the machine main frame **10** a punch press **29** is arranged which, as may be seen from FIG. **3**, is formed as an L-shaped unit with a leg **29***a* directed transversely of the main planes G and H and a leg **29***b* hanging downwards from the leg **29***a*. The leg **29***a* is guided on the upper edges of the main processing panels **11** and **12** by linear guides **30**. The linear guides **30** are here made so that the leg **29***a* cannot tilt away from the main processing panels **11** and **12**. Two worm wheel shafts **31** with worm wheels **32** are rotatably mounted in the leg **29***a* (in FIG. **3** only one of these worm wheels is illustrated). The worm wheels **32** mesh with the worm shaft **15** which is upwardly exposed between the upper edges of the main processing panels **11** and **12**. The worm wheel shafts **31** are coupled with two eccentric drive shafts **33** which are mounted at both ends in the leg **29***b*. On the exposed side of the leg **29***b* on each of the eccentric drive shafts **33** there are arranged further additional hydraulic motors which relieve the eccentric drive shafts **33** of torque. It is also possible to couple the two eccentric drive shafts **33** lying one behind the other in FIG. **3**, through a connecting gear wheel with one another and to permit an additional hydraulic motor **34** to act upon this connecting gear wheel.

The leg **29***b* forms a press frame with a press frame upper part **29***ba* and a press frame under part **29***bb*. In the press frame upper part **29***ba* a vertical guide **35** is formed for a press ram **36**. The press ram **36** is movable upwards and downwards by the eccentric drive shafts **33** through a total of four connecting rods **37**.

A press table **38** is formed on the press frame under part **29***bb*. A lower tool clamping plate **39** is secured on the press table **38**. This tool clamping plate **39** is adjustable in height by a wedge plate **40**. The wedge plate **40** lies on the press table **38** and in turn carries the lower tool clamping plate **39**. The wedge plate **40** is displaceable by a spindle drive **41** for the purpose of height adjustment of the tool clamping plate **39**. The spindle drive **41** is connected with a hydraulic spindle drive motor **42**. The tool clamping plate **39** is pressed by springs **43** against the wedge plate **40**, the latter at the same time being pressed against the press table **38**. After the height adjustment of the lower tool clamping plate **39** has taken place this plate is clamped fast in the position reached, by clamping means (not shown).

An upper tool clamping plate **44** is fitted on the press ram **36** for height adjustment in analogous manner by a wedge plate.

The lower press frame part **29***bb* is supported on a support rail **45** which is secured on the floor support spars **13** of the main frame **10**. The press frame under part **29***bb* is supported, as may be seen from FIG. **9***a*, on the support rail **45** by two roller bearing pedestals **46** of adjustable height, when the punch press **29** is to be displaced in the longitudinal direction of the linear guide **30**. When a specific end position of the punch press **29** is reached, the roller bearing pedestals **46** are displaced upwards in FIG. **9***a* so that support shoes **47** come into engagement with the support rail **45** and thus the punch press **29** is non-displaceably supported on the support rail **45**. Naturally still further securing means can be provided to secure the punch press **29** in the longitudinal direction of the linear guide **30** in operation.

The worm wheels **32** serving in operation for the rotation of the eccentric guide shafts **33** and thus for the upward and downward movement of the press ram **36** can also be used for the displacement of the punch press

29 in the direction of the arrow **48** in FIG. **1**, that is to say perpendicularly of the plane of the drawing in FIG. **3**. For this purpose it is necessary only to block the worm wheels **32** or the eccentric drive shafts **33** coupled with them. Then by rotation of the worm shaft **15** the punch press **29** can be displaced. Alternatively for the displacement of the punch press **29** in the direction of the arrow **48** in FIG. **1** it is also possible to make the worm shaft **15** fast and to drive the worm wheels **32** from the hydraulic motor **34**, so that the worm shaft **15** acts as a rack.

The press frame upper part **29***ba* is connected with the press frame under part **29***bb* by initially stressed tie rods **49**. These tie rods **49** pass through distance sleeves **50** which are arranged between the press frame upper part **29***ba* and the press frame under part **29***bb*. The tie rods **49** are subject to an initial stress which corresponds to the greatest press forces to be expected. The punch press **29** can be designed for example for up to 100 tons. The forces occurring in the punch press **29** are taken up by the tie rods **49** and not transmitted to the main machine frame **10**.

The distance sleeves **50** and the tie rods **49** are exchangeable for the adaptation of the press to workpieces of different heights; the fine adjustment is effected by the wedge plates **40**.

The leg **29***a* and the leg **29***b* can be produced as a one-piece casting; they can however also be divided approximately in the main processing plane H and screwed to one another.

The press frame upper part **29***ba*, as may be seen from FIG. **9**, can be assembled from three parts B, C and D placed together in sandwich manner and connected with one another, the vertical guide being formed in the parts B and D. By insertion or omission of the part C according to FIGS. **9** and **10** respectively then the width of the vertical guide **35** can be varied perpendicularly of the main processing planes G and H, so that press rams **36** of different widths can be used. The press frame under part **29***bb* can also be assembled in a corresponding manner.

The worm wheel shafts **31** in the punch press **29** provide additional power take-off positions **51** at their left ends in FIG. **3** for one or more processing units (not shown) which are continuously adjustable with the punch press **29**.

The cut-out shapes punched out of the material strips **28** and **28'** (FIG. **2**) by the press **29** can firstly be processed in the region of the main working plane H. For this purpose they are displaced out of the region of the punch press **29** to the respective processing position, by means of intermediate feed devices (not shown) which bring a plate approximately to the location designated by X in FIG. **2**. At this location X, various operations can be performed such as: welding operations by means of a welding unit **53***d*, shown in FIG. **16**; milling operations by means of a milling unit **53***a*, shown in FIG. **17**; drilling operations by means of a drilling unit **53***b*, shown in FIG. **18**; or thread cutting operations by means of a thread cutter **53***c*, shown in FIG. **14**. The thread cutter **53** and the welding plunger **52** are fitted on a processing unit **54** which is secured on the main processing panel **12** and driven by a main power take-off position **16***a* through an angle drive **55** (FIG. **2**). The processing unit **54** can also be fitted, as may be seen from FIG. **4**, with a bending unit **56** working obliquely of the main plane H.

It is also possible to feed further strip material in the main working plane H and divide it by further punch presses so that on the side of the main processing plane H different cut-out shapes obtained form different strip materials can be connected with one another.

The workpiece worked on the side of the main processing plane H is then transported into the other main processing plane G in order to be further processed there.

For the transport of the workpieces from the main processing plane H to the main processing plane G the main processing panels **11** and **12** are provided with workpiece passage openings **11***a* and **12***a* (FIGS. **1** and **4**) which are aligned with one another. The edges of these workpiece passage openings **11***a* and **12***a* are connected with one another by panels lying in secondary processing planes I, K, L and M standing perpendicularly of the main processing planes G and H. These panels can be cast integrally with the main frame **10**. Thus a passage shaft is defined through which the workpieces can pass from the main processing plane H to the main processing plane G. Additional securing means **57** for processing units, for example for bending abutments, can be fitted as may be seen from FIG. **4** on the edges of the workpiece passage openings **11***a* and **12***a*.

As illustrated in FIG. **5**, secondary power take-off positions **15***b*, **16***b*, **17***b* and **18***b* are allocated to the secondary processing planes, I, K, L and M. The secondary power take-off position **16***b* according to FIG. **5**—and the like is valid for the other secondary power take-off positions—comprises a worm wheel shaft **58** with a worm wheel **59** in engagement with the worm shaft **16**. The worm wheel shaft **58** penetrates the secondary processing plane K and a further secondary processing plane N on the outside of the main frame (FIG. **1**). The worm wheel shaft **58** can protrude beyond the secondary processing planes K and N as represented in FIG. **1**. It can however also terminate in the secondary processing planes K and N and be provided there with coupling devices similar to the coupling device **24** according to FIG. **3**. The secondary processing planes K and N are formed by panels which connect the main processing panels **11** and **12** with one another. These panels can be screwed fast on the main processing panels. By way of example in FIG. **3** there is seen a secondary processing panel **60** which corresponds to the secondary processing plane O in FIG. **1**.

According to FIG. **1** on the worm wheel shaft **58** within the workpiece passage **11***a*, **12***a* a transport wheel **61** is fitted which constitutes a further intermediate feed device which provides for the feed of the workpiece from the main processing plane H to the main processing plane G. A further correspondingly formed and driven transport wheel is designated according to FIG. **1** by **62**, allocated to the secondary processing plane L and driven by the secondary power take-off position **17***b*.

As soon as the workpiece has reached the main processing plane G under the action of the transport wheels **61** and **62**, it is further worked there by the bending units **25**.

The left end of the worm wheel shaft **58** in FIG. **1** is suitable for the drive of a processing unit for fitting on the secondary processing plane N or an accessory device to be fitted there. Securing means for processing units and the like can also be fitted on the secondary

processing planes N and O, for example in the form of undercut grooves.

The worm wheel shaft **58** of the secondary power take-off position **16***b* can be mounted in the secondary processing panels forming the secondary processing planes K and N, as indicated by the bearings **63** in FIG. **5**.

As may be seen from FIG. **6**, a strip feed unit **64** can also be fitted in the main processing plane G and is driven through a connecting rod drive **65** from a main power take-off position **17***a*. In departure from FIG. **1**, FIG. **6** shows on the main processing plane G a plurality of bending units **25**′ on the upper side of the workpiece passage **11***a*, **12***a*. On the underside of this workpiece passage there is fitted a processing unit **66** displaceable in the longitudinal direction. On the secondary processing plane O a vertical guide **67** is provided for a processing unit **68**. This processing unit, for example a strip intake unit, can be continuously displaceable and nevertheless driven by a fixed secondary power take-off position **18***b* (FIG. **5**). The direction of displacement is designated by **69** in FIG. **6**. FIG. **15** shows what is called a gear drive system; in this case **70** is a toothed wheel connected with the secondary power take-off position **18***b* and **71** a toothed wheel arranged on the processing unit **68**. The two toothed wheels **70** and **71** are connected with one another by an intermediate toothed wheel **72**. The intermediate toothed wheel **72** is carried by the middle joint of two arms **73** and **74**, the other ends of which are pivotable about the axes of the toothed wheels **70** and **71** respectively.

In FIG. **11** there is shown in detail the mounting of a worm wheel shaft **21** and the engagement of the worm wheel **22** with the worm shaft **15**. The worm wheel shaft **21** consists of two half shafts **21***a* and **21***b* which are carried in the bearings **23** of the main processing panels **11** and **12**. The half shafts **21***a* and **21***b* are inserted in to the worm wheel **22** and centered by it. They are held together by a tie bolt **21***c* which is accessible from the side of the main processing plane G. For torque transmission between the worm wheel **22** and the half shafts **21***a* and **21***b*, radial keys **21***d* or splines are provided. The tooth tips **22***e* of the worm wheel **22** are of arcuate curvature with a radius corresponding to the worm root radius of the worm shaft **15**. This ensures a great length of engagement between the worm shaft **15** and the worm wheel **22**.

For the fitting of the worm wheel **22** this wheel is held in engagement with the worm shaft **15** whereupon the half shafts **21***a* and **21***b* are pushed through the bearings **23** and then secured in the axial direction.

As may further be seen from FIG. **11** the coupling device **24** of the shaft **21** is formed by a cruciform slot. Correspondingly cruciform ribs **24**′ are provided as countercoupling device on the processing unit **25** to be attached, and engage in the cruciform slots **24**. In this way the shaft carrying the cruciform slots **24**′ of the processing unit **25** to be attached is centered on the shaft **21** and can be mounted in overhung manner in the processing unit.

According to FIG. **3** the main frame **10** is, up to the level of the upper worm shaft **15**, a closed hollow frame and accommodates an oil bath **75** into which the worm shaft **15** still partially dips. In this way all the moving parts within the main frame **10** are lubricated. The individual power take-off positions, the main power take-off positions and the secondary power take-off positions, are sealed off by the worm wheel shafts penetrating the pertinent walls, possibly with the use of additional sealing means.

The oil bath is upwardly covered by a cover plate **76** (FIG. **3**). This cover plate **76** permits passage of the worm shaft **15** and prevents the entry of dirt.

In the modified form of embodiment according to FIG. **7** the main frame **10** is formed above the workpiece passages **11***a* and **12***a* by a beam **77** composed of three sections **77***a*, **77***b* and **77***c*. The beam sections **77***a*, **77***b*, **77***c* are rotatably mounted on the main frame **10** and on one another, namely for rotation about the axis of the worm shaft **15**. Worm wheels with worm wheel shafts are mounted in the beam sections **77***a*, **77***b* and **77***c*, the arrangement corresponding to that in FIG. **11**. The worm wheels (not shown) are in engagement with the worm shaft **15**. As may be seen from FIG. **8** the sections **77***a*, **77***b*, **77***c* can be pivoted individually about the axis of the worm shaft **15** and made fast in any desired intermediate position by securing means (not shown). On the sections **77***a*, **77***b* and **77***c* again securing means in the form of undercut grooves **14** are provided so that bending units **25** or other processing units may be secured. Thus it becomes possible to work with the bending units in any desired working directions.

As may be seen from FIGS. **12** and **13** the main frame **10** is enclosed by a support frame **78**. The support frame **78** is of such stout formation that it can suppress vibrations of the main frame **10** in relation to its floor beams **13**. The support frame **78** comprises at least four vertical support columns **79** which are connected with one another by transverse girders **80** and longitudinal beams **81**, **82**, **83**, **84**. The lower transverse girders **80** are welded to the main frame **10**. On the longitudinal beam **81**, **82** a first transverse beam **85** is arranged which is mobile along the longitudinal beams **81** and **82**. A hoist **86** serving for the handling of processing units in the main processing plane H is mobile on the transverse beam **85** in the longitudinal direction of the transverse beam **85**. A corresponding hoist is allocated to the main processing plane G.

As may be seen from FIG. **12**, the pressure supply pump **27** which is driven by a motor **27***a* and to which an oil cooler **27***b* is allocated is arranged on the top on the support frame **78**.

On the support frame **78** there are arranged cladding parts **87** formed as sliding or pivoting doors which serve for the purpose of labor security as contact protection and possibly also as noise protection. All parts of the machine, with the exception possibly of the strip supply rolls, are accommodated within this cladding. The cladding parts can be produced from transparent material so that observation of the operations on the machine is possible without opening the cladding.

As additional labor protection measure it can be provided that when the frame is opened the machine can run only in inching operation, or not all.

We claim:

1. Workpiece processing machine, comprising a stationary main frame (**10**) having at least one main processing plane (G, H), worm shafts (**15**, **16**, **17**, **18**) arranged on the one side of this main processing plane (G, H) with their axes substantially parallel with the main processing plane (G, H), mounted in the stationary main frame (**10**) and connected with one another for drive, securing means (**14**) arranged on the other side of the main processing plane for the securing of processing units (**25**, **29**) on the stationary main frame (**10**), and—allocated to each worm shaft (**15**, **16**, **17**, **18**)—at least one

main power take-off position (**15***a*, **16***a*, **17***a*, **18***a*) for the drive connection of a processing unit (**25**, **29**) with the respective worm shaft (**15**, **16**, **17**, **18**) through a worm wheel (**22**) meshing with the worm shaft, with a worm wheel axis perpendicular to the main processing plane (G, H), at least three said worm shafts (**15**, **16**, **17**, **18**) connected for drive being arranged along mutually adjoining sides of a polygonal line, a workpiece passage (**11***a*, **12***a*) being provided in the processing plane (G, H) within the polygonal line.

2. Workpiece processing machine according to claim **1**, characterised in that the worm shafts (**15**, **16**, **17**, **18**) are arranged along at least three sides of a rectangular polygonal line.

3. Workpiece processing machine according to claim **2**, characterised in that the worm shafts (**15**, **16**, **17**, **18**) are arranged along the four sides of a rectangle.

4. Workpiece processing machine to claim **1**, characterised in that each main power take-off position (**15***a*, **16***a*, **17***a*, **18***a*) is constantly occupied, irrespective of the presence of a pertinent processing unit (**25**), with a worm wheel (**22**) and an associated worm wheel shaft (**21**) perpendicular to the main processing plane (G, H), the worm wheel shaft (**21**) comprising in the region of the main processing plane (G, H) a coupling device (**24**) for the coupling of a counter-coupling device (**24'**) of a processing unit (**25**).

5. Workpiece processing machine according to claim **1**, characterised in that the main processing plane (G, H) is defined by at least one main processing panel (**11**, **12**) which carries the securing means (**14**) for the attachment of at least one processing unit (**25**) and comprises, at an associated main power take-off position (**15***a*, **16***a*, **17***a*, **18***a*) a hole for the passage of the drive connection between the respective worm shaft (**15**, **16**, **17**) and the processing unit (**25**).

6. Workpiece processing machine according to claim **5**, characterised in that the holes on the main power take-off position (**15***a*, **16***a*, **17***a*, **18***a*) is closed by one of a worm wheel (**22**), a worm wheel shaft (**21**), and a coupling device (**24**).

7. Workpiece processing machine according to claim **1**, characterised in that the worm shafts (**15**, **16**, **17**, **18**) are connected with one another by bevel gears (**20**).

8. Workpiece processing machine according to claim **7**, characterised in that four worm shafts (**15**, **16**, **17**, **18**) are connected with one another by a total of three bevel wheel drives (**20**).

9. Workpiece processing machine especially according to claim **1**, characterised in that the worm shafts (**15**, **16**, **17**, **18**) are driven by a plurality of drive motors (**26**) running in synchronism.

10. Workpiece processing machine according to claim **9**, characterised in that a drive motor (**26**) is allocated to each of the two mutually remote ends of at least one worm shaft (**15**).

11. Workpiece processing machine according to claim **9**, characterised in that the drive motors (**26**) are hydraulic motors driven from a common pressure supply unit (**27**).

12. Workpiece processing machine according to claim **1**, characterised in that the workpiece passage (**11***a*, **12***a*,) is substantially rectangular, the defining sides of the rectangular workpiece passage (**11***a*, **12***a*) being substantially parallel to the worm shafts (**15**, **16**, **17**, **18**).

13. Workpiece processing machine, comprising a stationary main frame (**10**) having at least one main processing plane (G, H), worm shafts (**15**, **16**, **17**, **18**) arranged on the one side of this main processing plane (G, H) with their axes substantially parallel with the main processing plane (G, H), mounted in the stationary main frame (**10**) and connected with one another for drive, securing means (**14**) arranged on the other side of the main processing plane for the securing of processing units (**25**, **29**) on the stationary main frame (**10**), and—allocated to each worm shaft (**15**, **16**, **17**, **18**)—at least one main power take-off position (**15***a*, **16***a*, **17***a*, **18***a*) for the drive connection of a processing unit (**25**, **29**) with the respective worm shaft (**15**, **16**, **17**, **18**) through a worm wheel (**22**) meshing with the worm shaft, with a worm wheel axis perpendicular to the main processing plane (G, H), said at least three worm shafts (**15**, **16**, **17**, **18**) connected for drive being arranged along mutually adjoining sides of a polygonal line, main power take-off positions (**16***a*, **17***a*, **18***a*) being arranged to both sides of at least one of the worm shafts (**16**, **17**, **18**) when considering the main processing plane (G, H) in a direction perpendicular thereto.

14. Workpiece processing machine according to claim **13**, characterised in that at least one main power take-off position (**16***a*, **17***a*, **18***a*) on the one side of the worm shaft (**16**, **17**, **18**) is opposite to the gap between two main power take-off positions (**16***a*, **17***a*, **18***a*) on the other side of the worm shafts (**16**, **17**, **18**).

15. Workpiece processing machine according to claim **1**, characterised in that the worm shafts (**15**, **16**, **17**, **18**) are arranged between two mutually parallel main processing planes (G, H).

16. Workpiece processing machine according to claim **15**, characterised in that the main power take-off positions (**15***a*, **16***a*, **17***a*, **18***a*) in the two main processing planes (G, H) are aligned with one another by pairs in the direction perpendicular to the main processing planes (G, H).

17. Workpiece processing machine according to claim **16**, characterised in that a common worm wheel (**22**) and a common worm wheel shaft (**21**), which are mounted with their ends each in a main processing panel (**11**, **12**), are allocated to the main power take-off positions (**15***a*, **16***a*, **17***a*, **18***a*) aligned with one another in pairs.

18. Workpiece processing machine comprising a stationary main frame (**10**) having at least one main processing plane (G, H), worm shafts (**15**, **16**, **17**, **18**) arranged on the one side of this main processing plane (G, H)) with their axes substantially parallel with the main processing plane (G, H), mounted in the stationary main frame (**10**) and connected with one another for drive, securing means (**14**) arranged on the other side of the main processing plane for the securing of processing units (**25**, **29**) on the stationary main frame (**10**), and—allocated to each worm shaft (**15**, **16**, **17**, **18**)—at least one main power take-off position (**15***a*, **16***a*, **17***a*, **18***a*) for the drive connection of a processing unit (**25**, **29**) with the respective worm shaft (**15**, **16**, **17**, **18**) through a worm wheel (**22**) meshing with the worm shaft, with a worm wheel axis perpendicular to the main processing plane (G, H), at least three said worm shaft (**15**, **16**, **17**, **18**) connected for drive being arranged along mutually adjoining sides of a polygonal line, at least one secondary power take-off position (**16***b*, **17***b*, **18***b*) with a worm wheel axis parallel to the main processing plane is allocated to at least one of the work shaft (**16**, **17**, **18**).

19. Workpiece processing machine according to claim **18**, characterised in that the secondary power take-off position (**16***b*, **17***b*, **18***b*) is constantly occupied

with a worm wheel (**59**) and an associated worm wheel shaft (**58**), irrespective of the presence of a pertinent processing unit, and this worm wheel shaft comprises at least at one end a coupling device for the coupling of a counter-coupling device of a processing unit or the like.

20. Workpiece processing machine according to claim **18**, characterised in that at least one secondary processing plane (I, K, L, M, N, O) is provided perpendicularly of the main processing plane (G, H) and in that at least one secondary power take-off position (**16***b*, **17***b*, **18***b*) is allocated to this secondary processing plane.

21. Workpiece processing machine according to claim **20**, characterised in that the secondary processing plane (I, K, L, M, N, O) is formed by a secondary processing panel (**60**).

22. Workpiece processing machine according to claim **21**, characterised in that securing means for the securing of a processing unit (**61**, **62**, **69**) or the like are provided on the secondary processing panel.

23. Workpiece processing machine according to claim **22**, characterised in that the secondary processing panel extends between two main processing panels (**11**, **12**).

24. Workpiece processing machine according to claim **23**, characterised in that at least two mutually associated edges of workpiece passages (**11***a*, **12***a*) of two mutually parallel main processing panels (**11**, **12**) are connected by a secondary processing panel.

25. Workpiece processing machine according to claim **23**, characterised in that at least two mutually associated outer circumferential edges of two main processing panels (**11**, **12**) are connected by at least one secondary processing panel (**60**).

26. Workpiece processing machine comprising a stationary main frame (**10**) having at least one main processing plane (G, H), worm shafts (**15**, **16**, **17**, **18**) arranged on the one side of this main processing plane (G, H) with their axes substantially parallel with the main frame (**10**) and connected with one another for drive, securing means (**14**) arranged on the other side of the main processing plane for the securing of processing units (**25**, **29**) on the stationary main frame (**10**), and—allocated to each worm shaft (**15**, **16**, **17**, **18**)—at least one main power take-off position (**15***a*, **16***a*, **17***a*, **18***a*) for the drive connection of a processing unit (**25**, **29**) with the respective worm shaft (**15**, **16**, **17**, **18**) through a worm wheel (**22**) meshing with the worm shaft, with a worm wheel axis perpendicular to the main processing plane (G, H), at least three said worm shafts (**15**, **16**, **17**, **18**) connected for drive being arranged along mutually adjoining side of a polygonal line, at least one (**15**) of the worm shafts (**15**, **16**, **17**, **18**) being exposed with at least a part of its circumference on at least a part of its length to the outer space of the frame (**10**), in that on the main frame (**10**) parallel with the exposed section of the worm shaft (**15**) there is provided a linear guide (**30**) for a continuously displaceable and securable processing unit (**29**) and in that on this continuously displaceable processing unit (**29**) there is mounted at least one worm wheel (**32**) for engagement with the exposed section of the worm shaft (**15**).

27. Workpiece processing machine according to claim **26**, characterised in that the exposed worm shaft (**15**) is exposed in a direction parallel to the main processing plane (G, H) and in that the worm wheel (**32**) of the continuously displaceable processing unit (**29**) stands with an axis perpendicular to the main processing plane (G, H).

28. Workpiece processing machine according to claim **27**, characterised in that the continuously displaceable processing unit (**29**) is of L-shaped formation, seen in the direction of the linear guide (**30**), with a first leg (**29***a*) extending substantially transversely of the main processing plane (G, H), having guide elements for the guidance on the linear guide (**30**), and on which the worm wheel (**32**), meshing with the exposed worm shaft (**15**), of the continuously displaceable processing unit (**29**) is mounted and having a second leg (**29***b*) extending substantially parallel with a

29. Workpiece processing machine according to claim **28**, characterised in that the processing unit (**29**) comprises a punch press.

30. Workpiece processing machine according to claim **29**, characterised in that in the second leg (**29***ba*, **29***bb*) a press frame is formed having a first press frame post (**29***ba*) adjoining the first leg (**29***a*) and connected therewith and a second press frame part (**29***bb*) apart from the first leg (**29***a*) and connected with the first press frame part (**29***ba*), at least one eccentric drive shaft (**33**) being mounted in the first press frame part (**29***ba*) and connected for drive with the worm wheel (**32**), while furthermore in the first press frame part (**29***ba*) a ram guide (**35**) for a press ram (**36**) is arranged in the longitudinal direction of the second leg (**29***b*), while furthermore in the ram guide (**35**) a press ram (**36**) is displaceably guide, while furthermore the press ram (**36**) is connected through at least one connecting rod (**37**) with the eccentric drive shaft (**33**), and a press table (**38**) is arranged on the second press frame part (**29***bb*).

31. Workpiece processing machine especially according to claim **30**, characterised in that the second press frame part (**29***bb*) is connected with the first press frame part (**29***ba*) by distance pieces (**50**) and tie rods (**49**) under prestress.

32. Workpiece processing machine according to claim **31**, characterised in that the distance pieces (**50**) are distance sleeves which are penetrated each by a tie rod (**49**).

33. Workpiece processing machine according to claim **31**, characterised in that the tie rods (**49**) extend over the entire length of the second leg (**29***b*).

34. Workpiece processing machine according to claim **30**, characterised in that the eccentric drive shaft (**33**) is arranged axially parallel with the worm wheel (**32**) of the continuously displaceable processing unit (**29**).

35. Workpiece processing machine especially according to claim **30**, characterised in that an end of the eccentric drive shaft (**33**) remote from the worm wheel shaft (**31**) of the continuously displaceable processing unit (**29**) is connected with an additional motor (**34**), especially a hydraulic motor, which may be connected to the same pressure supply unit (**27**) as the drive motors (**26**) of the worm shafts (**15**, **16**, **17**, **18**).

36. Workpiece processing machine especially according to claim **30**, characterised in that a tool clamping plate (**39**, **44**) is arranged displaceably in the working direction of the press ram (**36**) at least one of the press ram (**36**) and the press table (**38**).

37. Workpiece processing machine according to claim **36**, characterised in that the tool clamping plate (**39**, **44**) is displaceable by a wedge plate (**40**) displaceable transversely of the working direction of the press ram (**36**).

38. Workpiece processing machine according to claim 37, characterised in that the wedge plate (40) is displaceable by a spindle drive (41).

39. Workpiece processing machine according to claim 38, characterised in that a spindle drive motor (42), especially a hydraulic spindle drive motor (42), is associated with the spindle drive (41).

40. Workpiece processing machine according to claim 37, characterised in that the tool clamping plate (38, 44) is connected with the respective one of the press ram (36) and the press table (38) by at least one presser spring (43) which holds the tool clamping plate (39, 44) in engagement with the wedge plate (40) and the wedge plate in engagement with the respective one of the press ram (36) and the press table (38).

41. Workpiece processing machine according to claim 38, characterised by clamping means for clamping the tool clamping plate (39, 44) with respect to the wedge plate (40) and the wedge plate (40) with respect to the respective one of the press ram (36) and the press table (38).

42. Workpiece processing machine according to claim 28, characterised in that the exposed worm shaft (15) runs horizontally along the upper edge of the main processing panel (11, 12) and in that the second leg (29*b*) hangs downwards starting from the first leg (29*a*).

43. Workpiece processing machine according to claim 42, characterised in that the second leg (29*b*) is mounted on a support track (45) extending parallel with the linear guide (30).

44. Workpiece processing machine according to claim 43, characterised in that for the mounting of the second leg (29*b*) on the support track (45) the second leg (29*b*) is provided with at least one support shoe (47) and at least one roller bearing (46) of adjustable height.

45. Workpiece processing machine according to claim 28, characterised in that the first leg (29*a*) and the second leg (29*b*) are produced as separate construction units and connected with one another.

46. Workpiece processing machine according to claim 30, characterised in that at least one of the first press frame part (29*ba*) and the second press frame part (29*bb*) is assembled from sandwich parts (B, C, D), at least one of said press ram (36) and said press table (38) being variable in width.

47. Workpiece processing machine according to claim 28, characterised in that at least one additional power take-off position (51) for a further processing unit is fitted on the first leg (29*a*).

48. Workpiece processing machine according to claim 1, characterised in that the stationary main frame is formed essentially by two main processing panels (11, 12) forming main processing planes (G, H), which are connected with one another by distance members.

49. Workpiece processing machine according to claim 48, characterised in that the distance members are formed at least partially by panels (60) perpendicular to the main processing panels (11, 12), which define secondary processing planes (I, K, L, M, N, O).

50. Workpiece processing machine especially according to claim 1, characterised in that the stationary main frame (10) is formed at least partially as a hollow frame accommodating an oil bath (75).

51. Workpiece processing machine according to claim 50, characterised in that the oil bath (75) reaches at least as far as the highest horizontal worm shaft (15).

52. Workpiece processing machine according to claim 1, characterised by at least one feed unit (64) feeding one of wire and strip materials and preceding a stamping press (29).

53. Workpiece processing machine according to claim 52, characterised in that the feed unit (64) is driven through one of the power take-off positions (17*a*) by one of the worm shafts (17).

54. Workpiece processing machine according to claim 52, characterised in that the feed unit (64) is designed for a feed direction parallel to the main processing plane (G, H).

55. Workpiece processing machine according to claim 52, characterised in that the feed unit 64 is designed for a feed perpendicular to the main processing plane (G, H).

56. Workpiece processing machine especially according to claim 1, characterised by intermediate feed devices (61, 62) for the transport of the sections cut off from one of the strip (28, 28') and wire materials from one processing position (29) to a further processing position (X).

57. Workpiece processing machine according to claim 56, characterised in that an intermediate feed device (61, 62) is formed for the transport of the sections cut off from one of the strip and wire materials through the workpiece passage (11*a*, 12*a*).

58. Workpiece processing machine according to claim 57, characterised in that an intermediate feed device (61, 62) is formed for the transport of the sections cut off from one of the strip and wire materials from the one main processing plane (H) to the other main processing plane (G) and is driven from a secondary power take-off positions (16*a*, 17*a*).

59. Workpiece processing machine according to claim 1 characterised in that at least one processing unit (68) connected to a specific power take-off position is arranged continuously displaceably on the frame (10) and is connected with a power take-off position (18*b*) through an adjustable gear drive system (70, 71, 72) comprising a group of at least three gears in series namely two terminal gears and a middle gear, said terminal gears meshing with said middle gear and being mounted with their respective axes in respective carriers mounted for swinging movement about the axis of said middle gear.

60. Workpiece processing machine according to claim 1, characterised in that at least one processing unit (25) is formed as a bending unit.

61. Workpiece processing machine according to claim 1, characterised in that at least one processing unit is formed as a welding unit (52).

62. Workpiece processing machine according to claim 1, characterised in that at least one processing unit (54) is formed as one of a drilling unit and milling unit.

63. Workpiece processing machine according to claim 1, characterised in that at least one processing unit (54) is formed as a thread-cutting unit.

64. Workpiece processing machine according to claim 1, characterised in that at least one processing unit (54) is connected to a power take-off position (16*a*) through an angle drive (55).

65. Workpiece processing machine especially according to claim 4, characterised in that the coupling device (24) of a worm wheel shaft (21) is formed as one of a cruciform slot and cruciform rib, the point of crossing of which coincides with the shaft axis.

66. Workpiece processing machine especially according to claim 4, characterised in that the worm wheel shaft (21) consists of two half shafts (21*a*, 21*b*) which are

aligned and connected fast in rotation with one another and with the worm wheel (22) by the undivided worm wheel (22) and are mounted outside the worm wheel (22) by bearing arrangement (23) in the main processing panels (11, 12).

67. Workpiece processing machine according to claim 66, characterised in that the half shafts (21*a*, 21*b*) are dimensioned such that they can be introduced in opposite directions through the respective bearing arrangement (23) into engagement with the worm wheel (22) held in the working position in relation to the worm shaft (15).

68. Workpiece processing machine especially according to claim 1, characterised in that the stationary main frame (10) is stabilised by an external support frame (78).

69. Workpiece processing machine according to claim 68, characterised in that the support frame (78) is the carrier of at least one of a contact guard cladding and a sound protection cladding (87).

70. Workpiece processing machine according to claim 69, characterised in that said at least one of said claddings (87) is transparent.

71. Workpiece processing machine according to claim 69, characterised in that said at least one of said claddings (87) is displaceable by sections.

72. Workpiece processing machine according to claim 68, characterised in that the stationary main frame (10) comprises floor support beams (13) extending transversely of the main plane and in that the support frame (78) is connected with the floor support beams (13) in the region of their free ends and with the main frame (10) in its upper region.

73. Workpiece processing machine especially according to claim 68, characterised in that the support frame (78) comprises at least two guide beams (81, 82, 83, 84) arranged above the stationary frame (10) and extending parallel with the main processing planes (G, H), and in that at least one transverse beam (85) extending transversely of the main processing plane (G, H) and displaceable in the longitudinal direction of the guide beams (81, 82, 83, 84) is guided on these guide beams (81, 82, 83, 84), and in that on this transverse beam (85) there is arranged at least one hoist and conveyor means (86) for the handling of processing units in the region of the machine.

74. Workpiece processing machine according to claim 73, characterised in that the hoist and conveyor means (86) is mobile along the transverse beam (85), that is perpendicularly of the main processing plane (G, H).

75. Workpiece processing machine according to claim 73, characterised in that where two main processing planes (G, H) are present the support frame (78) for each main processing plane (G, H) comprises two guide beams (81, 82) and (83, 84) and at least one transverse beam (85), extending between these guide beams, each with a hoist and conveyor means (86).

76. Workpiece processing machine especially according to claim 1, characterised in that a frame beam (77) extending along a worm shaft (15) comprises at least one beam segment (77*a*, 77*b*, 77*c*) pivotable about the worm shaft (15), in which there is mounted at least one worm wheel shaft with a worm wheel engaging in the worm shaft (15) and with at least one power take-off position and on which securing means are provided for at least one processing unit (25).

77. Workpiece processing machine according to claim 1, characterised in that the tooth tips (22*e*) of the worm wheel (22) are of partial arc form and adapted to the worm root diameter of the worm shaft (15).

78. Workpiece processing machine according to claim 5, characterised in that two mutually parallel main processing panels each defining a main processing plane are formed by an integral casting.

79. Workpiece processing machine according to claim 79, characterised in that the mountings (19) for the worm shafts (15, 16, 17, 18) in the casting are formed integrally therewith.

80. Workpiece processing machine, comprising a stationary main frame (10) having at least one main processing plane (G), a drive system including at least one worm shaft (15) arranged on the one side of this main processing plane (G) with its axis substantially parallel with the main processing plane (G) mounted in the stationary main frame (10), securing means (14) arranged on the other side of said main processing plane (G) for the securing of processing units (25, 29) on the stationary frame (10), said processing unit (25, 29) being drivingly connectable with said drive system, at least one subframe (77*a*, 77*b*, 77*c*) being mounted with respect to said stationary main frame (10) about an axis coincident with the axis of said worm shaft (15), said subframe (77*a*, 77*b*, 77*c*) being provided with a subframe processing plane, said subframe processing plane being provided with securing means (14) arranged on the side of said subframe processing plane which is remote from said worm shaft (15), at least one power take-off position being provided within said subframe processing plane for the drive connection of a processing unit (25) with said worm shaft (15) through a worm wheel meshing with said worm shaft (15) with the worm wheel axis perpendicular to said subframe processing plane.

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